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Corporate Governance, Audit Quality, and the Sarbanes-Oxley Act: Evidence from Internal Audit Outsourcing

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ABSTRACT: This study extends current literature related to nonaudit services by investigating internal audit outsourcing to the external auditor. We posit that certain types of internal audit outsourcing (i.e., those which are nonroutine, and thus tend to be nonrecurring in nature) are unlikely to lead to economic bonding, while offering significant potential for improvements in audit coverage and scope when provided by the external auditor. Alternatively, outsourcing routine internal audit tasks is more likely to lead to economic bonding, as well as potentially threatening internal auditor independence. Our results are consistent with firms with independent, active, and expert audit committees being less likely to outsource routine internal auditing activities to the external auditor. However, the outsourcing of nonroutine internal audit activities such as special projects and EDP consulting are not negatively related to effective audit committees. Additionally, outsourcing of either type of internal audit activity to an outside service provider other than the external auditor is not related to effective audit committees. Collectively, we interpret these findings as supportive of an effective audit committee's ability to monitor the sourcing of the firm's total (i.e., internal and external) audit coverage, while simultaneously exhibiting concern for external auditor independence.

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I. INTRODUCTION

The Sarbanes-Oxley Act of 2002 (U.S. House of Representatives 2002) (hereafter, SOX) severely restricts outsourcing of any internal audit (IA) functions to a client firm's external auditor due to independence concerns.[1] SOX restrictions on IA outsourcing represent an extension of the Auditor Independence Rules of 2000, which mandated a 40 percent ceiling on IA activities related to the internal accounting controls that could be outsourced to the external auditor (effective in 2001).[2] However, the Institute of Internal Auditors (IIA 1996, 1994) and other financial reporting constituents argue that such outsourcing can be a beneficial and cost-effective means of improving internal and external audit quality. These diverse opinions may result from a scarcity of evidence concerning the different types of IA functions outsourced and the merits of outsourcing to various service providers.

During the deliberations surrounding both SOX and the Auditor Independence Rules, two underlying assumptions were operative. First, all IA outsourcing (regardless of type) to the external auditor was assumed to have equally deleterious effects on auditor independence and overall audit quality. The assumption that all nonaudit services (NAS) impair audit quality, regardless of their nature, is one commonly found throughout much of prior NAS-audit quality research (Chung and Kallapur 2003; Frankel et al. 2002; DeFond et al. 2002). Second, the IA outsourcing decision was assumed to be primarily the province of management, also a common assumption in prior IA outsourcing research (Caplan and Kirschenheiter 2000; Widener and Selto 1999; Krishnan and Zhou 1997). However, this assumption has also been called into question by the growing stream of research focusing on the beneficial effects of independent, expert, and active audit committees (Abbott et al. 2004; Carcello and Neal 2000).

In this paper we extend prior research by examining whether different *types* of IA activities outsourced to the external auditor are viewed differently by a key stakeholder in this decision: the audit committee. In particular, we categorize the specific types of outsourced IA activities as routine or nonroutine, following the taxonomy of previous outsourcing studies (Pelfrey and Peacock 1995). We posit that outsourcing routine internal audit activities threatens external auditor independence, due to its recurring nature, which may lead to economic bonding (Beck et al. 1988; Simunic 1984).[3] Outsourcing routine internal audit activities may also impair internal audit independence by raising the specter of total internal audit outsourcing, and in the process threatening internal auditors' job security (Rittenberg et al. 1999; Quarles 1994; Kalbers and Fogarty 1993). As Caplan and Emby (2004) find negligible quality differences in routine tasks performed by internal and external auditors, outsourcing routine tasks appears to present significant risks to internal and external auditor independence without enhancing overall quality.

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[1] SOX section 201 prohibits external auditors from providing to audit clients any outsourcing services that relate to the client's internal controls, financial systems, or financial statements.

[2] Under the final rule, an auditor's independence is impaired by performing more than 40 percent of the audit client's internal audit work related to the internal accounting controls, financial systems, or financial statements, unless the audit client has $200 million or less in assets.

[3] We utilize the term "economic bonding" to refer to a situation in which the joint performance of auditing and other services reduces the probability of truthful reporting (Simunic 1984).

Outsourcing nonroutine tasks to the external auditor has a more complex impact on audit quality for three primary reasons. First, unlike routine activities, nonroutine tasks are likely to be nonrecurring, reducing the potential for economic bonding (Beck et al. 1988). Second, these outsourced nonroutine tasks often require specialized knowledge, such as EDP audit expertise, which may be difficult for internal auditors to obtain in-house. If these tasks are outsourced to the external auditor, then there may be significant financial statement audit synergies in both cost and audit scope, potentially resulting in increased audit quality (Smith 2002; Aldhizer and Cashell 1996; Simunic 1984). Third, using the external auditor to perform nonroutine tasks may also be more efficient (versus using another outside service provider) due to the external auditor's familiarity with the client and its IA function (Smith 2002; Krishnan and Zhou 1997). This familiarity also provides for a more seamless integration into the IA function's coordination and training efforts (McDonald 2003; Smith 2002). Consequently, we argue that outsourcing nonroutine tasks to the external auditor may provide significant advantages, without the potential independence impairment presented by the routine tasks. Whether the potential benefits outweigh the possibility of impaired independence in appearance is an empirical question.

We also depart from the assumption that management is the sole outsourcing decision maker. Developments in regulation or best practices predating our sample period emphasize the audit committee's role in the oversight of the internal and external audit functions (Blue Ribbon Committee 1999). Consistent with this regulatory focus, we expect effective audit committees (defined as committees that are comprised entirely of independent directors, meet at least four times annually, and contain at least one director possessing financial expertise) to exert significant influence in the outsourcing decision. We base our supposition on three premises. First, financial misstatements threaten the reputational capital developed by these effective audit committee directors (Srinivasan 2005; Abbott and Parker 2000; Beasley 1996). Consequently, a change in any component critical to the financial reporting process is of concern to an effective audit committee. Second, as the Treadway Commission (NCFFR 1987) asserts, the IA function assists the audit committee in discharging its oversight responsibilities. Accordingly, an audit committee that is actively monitoring the IA function and understands its role in the internal control structure is likely to understand the impact of outsourcing (Raghunandan et al. 2001). Finally, given their monitoring role, effective audit committees are likely to be sensitive to actual or perceived independence threats to both the external and internal auditors (Abbott et al. 2003b; DeZoort 1997).

Given the aforementioned risks to external and internal audit independence (without a commensurate increase in audit quality), we hypothesize that effective audit committees are less likely to be associated with outsourcing of routine tasks to the external auditor. In addition, we argue that this effect will be heightened when the internal audit function reports directly to the audit committee. This is because under such reporting arrangements the audit committee is more informed about the outsourcing relationships. However, in the case of nonroutine tasks, the potential for economic bonding may be offset by improvements in audit coverage, efficiency, and/or provider expertise. Thus, we do not make a directional prediction with respect to the relation between audit committee characteristics and the outsourcing of nonroutine tasks.

To test our hypotheses we obtained 219 survey responses from *Fortune* 1000 companies concerning the nature, extent, and provider of IA outsourcing in 2000. Our sample period represents an ideal test setting for two reasons. First, the year 2000 was a period in which relatively few regulatory restrictions existed on the choice and nature of outsourcing activities. Second, the mid-1990s saw an explosion in the popularity of outsourcing, with 2000 likely representing the peak year of this phenomenon (Rittenberg and Covaleski 2001; Weil 2001).[4] Our survey was addressed to the Chief Internal Auditors (CIAs) of the sample firms, because we expect the CIAs to have the greatest authority in the outsourcing decision and the greatest knowledge of its benefits and costs (Serafini et al. 2003).

Using a logit regression, we first test whether there is a relation between audit committees with strong governance characteristics and the outsourcing of any internal audit tasks to the external auditor. Our measure of audit committee effectiveness (*ACE*) is a composite variable with the value 1 if the committee meets at least four times in the sample year, is entirely independent, and includes at least one financial expert. This information was obtained from the firms' proxy statements. We find that *ACE* is negatively associated with the use of the external auditor as an outsourcing provider. This effect is enhanced when the audit committee also has hiring and retention authority over the Chief Internal Auditor. Hiring and retention authority information, captured by our *AUTHORITY* variable, was obtained via our survey instrument.[5]

We then use Tobit analysis to determine whether there is a differential relation between our *ACE* variable and the type of internal audit tasks outsourced. As predicted by our hypotheses, we document a significant negative relation between *ACE* and the proportion of routine internal audit tasks outsourced to the external auditor. This effect is heightened when *AUTHORITY* and *ACE* are interacted. We find no significant relation between *ACE* and the proportion of nonroutine outsourcing. This is consistent with audit committees with stronger governance differentiating between routine and nonroutine tasks when approving outsourcing arrangements. When we perform similar tests for the proportion of outsourcing of routine and nonroutine tasks to other outside service providers (OSPs), we fail to document any relation between our test and dependent variables.

Last, we examine only the subsample of firms that outsource to the external auditor. We find within this subsample that the significant negative relation between ACE and the proportion of routine tasks outsourced to the external auditor remains. This suggests that audit committee governance influences the type of outsourcing undertaken, after the initial decision to use the external auditor as the outsourcing provider has been made. Collectively, we interpret these findings as supportive of an effective audit committee's ability to optimally monitor the sourcing of the firm's *total* (i.e., internal and external) audit coverage, while simultaneously ensuring external and internal auditor independence.

Our findings extend the current literature in audit quality and nonaudit services, by differentiating between different types of NAS. More specifically, much of this prior research has typically assumed that all NAS have an equally negative impact on auditor independence (DeFond and Francis 2005). Unlike prior studies, our findings are consistent with different types of NAS potentially having differential effects on audit quality. In particular, as also acknowledged by the Securities and Exchange Commission (SEC 2003), there may be instances where a large NAS-audit fee ratio is *not* indicative of impaired auditor independence because of the nature of the NAS being provided. However, most prior research that has used nonaudit fee data disclosed pursuant to FFR No. 56 (SEC

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[4] In particular, the AICPA released an Official Interpretation in May 1996 that concluded that outsourcing did not impair external auditor independence as long as a member of management remained in charge of the internal audit function. The consequence of this "green light" was a dramatic growth in internal audit outsourcing through 2000 (Rittenberg and Covaleski 2001). Our sample data confirm the prediction of Rittenberg and Covaleski (2001) and suggest an increased economic impact of outsourcing.

[5] Employment authority is indicative of higher institutional influence for the internal audit function and greater interest in internal audit by the committee (DeZoort 1997).

2000b) have generally treated all NAS as equally independence impairing due to the regulatory disclosure regime that pooled all nonaudit services into a single category. Consequently, our results also support the SEC's actions in FFR No. 68 (SEC 2003) to require more finely partitioned nonaudit fee data.[6]

Our paper also complements a growing stream of literature investigating the role of the audit committee in corporate governance. We provide evidence on the ability of effective audit committees to discriminate between NAS having differential impacts on audit quality. Our results are consistent with effective audit committees acting as sophisticated consumers of nonaudit services. Our findings are also consistent with those of Gaynor et al. (2006) who find (in an experimental setting) that audit committee members prefer joint provision of audit services when such provision contributes to audit quality. Finally, our paper also contributes to the literature by providing initial, large-scale empirical evidence on the amount, nature, and providers of IA outsourcing activities.

Our results have implications related to SOX restrictions on internal audit outsourcing. As it stands, SOX prevents any audit quality improvements that may result from selectively outsourcing to the external auditor. By the same token, SOX may also prevent firms with weak governance from making decisions that are independence impairing. Thus, the overall effect of the virtual moratorium on IA outsourcing may not be easy to ascertain. Nonetheless, a loosening of the regulation may be beneficial, particularly in light of the other corporate governance changes enacted by SOX (such as stricter audit committee requirements for independence and expertise).

Furthermore, relaxing the restrictions might create future benefits from selective outsourcing. For example, the use of enterprise resource management and customer relations management systems by client firms continues to increase. The pervasiveness of these systems and others like them has heightened the demand for EDP-auditing-related expertise in these areas (Serafini et al. 2003; McDonald 2003). Moreover, such systems also pose increased audit risks (Harkness and Green 2004; Lightle and Vallario 2003; Glover et al. 1999). The demand for EDP-auditing expertise is unlikely to diminish over time given the rapid pace of change in information technology. Hence, both the demand for EDP auditing expertise and the potential increase in audit quality resulting from knowledge spillovers gained from outsourcing EDP auditing has intensified and can be expected to continue. Additionally, smaller IA departments might benefit the most in terms of the expertise, cost savings, and coordination ease afforded by the external auditor. This becomes a particularly salient issue when considering the recent NYSE listing requirement that all registrants have an internal audit department.

Our results are consistent with the views expressed by Jacqueline Wagner, Chairman of the IIA, who stated during the Auditor Independence Rules hearings, "We simply do not believe that it is possible for a single central authority in either the public or private sector to answer these (outsourcing and nonaudit service related) questions for all publicly held organizations in the United States. There are too many permutations in sizes and relationships of both firms and their clients to make this feasible ... the audit committee can best judge any potential impairment of independence based on the specific circumstances of the firm and its auditors" (SEC 2000a).

The remainder of this paper is structured as follows: Section II reviews prior literature, Section III develops the hypotheses, Section IV discusses sample selection methodology, Section V presents research design and results, and Section VI concludes.

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[6] Mishra et al. (2005) find evidence consistent with the assertion that investors' perceptions vary depending on the type of nonaudit fees.

II. PREVIOUS LITERATURE

Prior Internal Audit Outsourcing Research

Previous research has identified several motivations for outsourcing IA activities. For example, Caplan and Kirschenheiter (2000) model outsourcing demand as a function of control risk and an aversion to potential losses resulting from internal control breakdowns. In addition to the factors described in Caplan and Kirschenheiter (2000), Petravick (1997) describes three factors important to outsourcers: the reduction of redundant audit work (resulting in external audit cost savings); the professional liability insurance of the external auditor; and the prestige and technological specialization of the external auditor.

The most recent empirical outsourcing study of which we are aware is Widener and Selto (1999). Widener and Selto (1999) find statistically negative relations between the degree of outsourcing and proxies for asset specificity and frequency. However, Widener and Selto (1999) do not consider the role of the audit committee in their analyses, differentiate between outsourcing providers or distinguish between different outsourcing activities. In the following sections, we develop the role of an effective audit committee in the various facets of the internal audit outsourcing decision.

Audit Committee Effectiveness and the Demand for Overall Audit Quality

Abbott and Parker (2000) posit that outside, independent audit committee directors possess a two-factor audit quality demand function. First, while audit committee service may increase the reputational capital of outside directors, it may also exacerbate the reputational damage should a financial misstatement occur (Srinivasan 2005; Beasley 1996; Fama and Jensen 1983). The second demand factor concerns director liability, which is also rooted in a desire to avoid financial misstatement (Reinstein et al. 1984).

DeZoort et al. (2002) note two other elements essential (in support of audit committee independence) for the creation of audit committee effectiveness. Diligence—often measured by the number of audit committee meetings—signals the committee's desire to execute its duties (Menon and Williams 1994; Kalbers and Fogarty 1993). Financial expertise aids the committee in understanding audit risks and communicating with the internal and external auditors (Maines et al. 2002; DeZoort and Salterio 2001). While audit committees are the chief overseers of the external and internal audit functions (DeZoort et al. 2002), audit committees rely heavily on both functions in ensuring overall audit quality.

Recent empirical studies have affirmed the positive associations between audit committee independence, diligence, and expertise and various forms of external audit and internal audit quality. For example, Abbott et al. (2003a) find that audit committees comprised entirely of independent directors who meet at least four times annually are associated with greater external audit scope, which should, *ceteris paribus*, reduce the likelihood of financial misstatement. In terms of internal audit quality, Raghunandan et al. (1998) find that audit committees that reviewed both internal audit's program and results thereof were more likely to be perceived as knowledgeable about accounting and auditing issues by the company's Chief Internal Auditor. The results of Raghunandan et al. (1998) also affirm the symbiotic relationship between the audit committee and internal audit as described by the Treadway Commission (Raghunandan et al. 2001; Scarborough et al. 1998; Raghunandan et al. 1998).

In sum, prior research suggests that audit committees exhibiting corporate governance characteristics consistent with those prescribed by SOX (independence, diligence, and financial expertise) demonstrate a demand for external and internal audit quality as a means of avoiding financial misstatement. Henceforth, we refer to audit committees simultaneously exhibiting the characteristics of independence, diligence, and financial expertise as "effective" audit committees.

The Impact of Outsourcing Routine Internal Audit Activities on Audit Quality

The impact of outsourcing on external auditor independence has been a concern of regulators for some time. Underscoring these concerns is a belief that an external auditor's willingness to disagree with management on financial reporting and internal control issues varies inversely with the percentage of revenues derived from a single client (Haynes et al. 1998; DeAngelo 1981). These concerns are exacerbated when the nonaudit services provided are recurring in nature, thus providing a continuing stream of economic rents (Parkash and Venable 1993; Beck et al. 1988). The outsourcing of routine IA functions fits the recurring description since many of these activities are performed not only on an annual basis, but on a continuous one as well (Aldhizer et al. 2003; Pelfrey and Peacock 1995).

Outsourcing routine IA functions to the external auditor may also threaten *internal* audit independence. Specifically, internal auditors with uncertain job status may be less likely to disagree with management on internal control issues, reducing the likelihood that such issues would be communicated to the audit committee (Rittenberg et al. 1999; Quarles 1994; Kalbers and Fogarty 1993). This is particularly true when outsourcing routine or "core" IA functions, often leading to "turf battles" between the internal auditor and the outsource provider (Del Vecchio and Clinton 2003; Thomas and Parish 1999). However, the turf battles arise only in cases of outsourcing to the external auditor. This is because the external auditor must also report to the audit committee, whereas other outsourcing service providers generally report to the Chief Internal Auditor (Serafini et al. 2003). The external auditor's ability to continually market outsourcing services may raise the specter of *total* IA outsourcing, furthering the threat to internal auditors. Thus, the negative impact on internal audit independence provides a second rationale for effective audit committees to resist outsourcing routine internal audit activities to the external auditor.

As a final consideration of the audit committee, it is unlikely that outsourcing routine IA activities will improve overall audit quality as the external auditor does not have a differential quality advantage in providing such services (Caplan and Emby 2004).[7] Outsourcing routine IA activities thus entails high expected costs of impaired auditor independence (both internal and external) and minimal increases in audit quality. Consequently, we posit that effective audit committees are less likely to approve of such outsourcing arrangements.

The Impact of Outsourcing EDP Auditing and Special Projects on Audit Quality

While the results of Caplan and Emby (2004) call into question outside service providers' (both external auditors and outside service providers [OSPs]) claims of superior audit quality, there are instances when internal auditors themselves acknowledge quality differences. These instances are almost universally found in the areas of EDP auditing and other special consulting projects (Serafini et al. 2003; McDonald 2003; Del Vecchio and Clinton 2003). The IIA (1996) notes there are economies of scale that allow outside service providers (whether an OSP or the external auditor) to employ specialists, such as EDP auditors, who may not be cost-effective to hire or develop in-house.[8]

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[7] Caplan and Emby (2004) use a series of cases involving tests of controls—a routine internal audit task—to compare internal auditors to external auditors. Caplan and Emby (2004) find substantial similarity between the two groups and conclude that there are negligible quality differences between internal and outside auditors (whether the current external auditor or an OSP)—in terms of *routine* IA operations.

While quality advantages for outsourcers of EDP auditing may be apparent, this still does not explain why firms might choose the external auditor vis-à-vis an OSP to provide such outsourcing services. A review of the literature reveals three distinct advantages the external auditor has over the OSP in providing specialized IA outsourced activities. First, and of foremost concern to the audit committee, knowledge spillovers create synergies between outsourcing of EDP auditing and the financial statement audit (Smith 2002; Verschoor 1992; Simunic 1984). These synergies can result in a more comprehensive financial statement audit (Aldhizer and Cashell 1996; Simunic 1984).[9] Second, the external auditor's knowledge of the client's corporate culture, IA function, and accounting systems also facilitates coordination efforts between the two sets of auditors, leading to further audit efficiencies (Smith 2002; Thomas and Parish 1999; Aldhizer and Cashell 1996).

The external auditor's familiarity with the client's accounting system has one final advantage: the reduction in the risk of budget overruns (Krishnan and Zhou 1997). Since EDP auditing expertise may be extremely cost-prohibitive to develop in-house (IIA 1996), this heightens the external auditor's informational advantage. Even if the external auditor's bid for a particular task may be higher than an OSP's, the auditor's informational advantage allows her to make a bid that is likely to be more precise. Such precision reduces the potential for costly, *ex post* settling up of outsourcing contracts, while ensuring adequate audit coverage (Smith 2002).[10] Given the chief internal auditor's—and audit committee's—desire to maximize audit coverage subject to budget constraints (Newman et al. 1998), outsourcing EDP auditing to the external auditor appears to be a sound, less risky (in terms of budget overruns) strategy.

The unique advantages of outsourcing EDP auditing to the external auditor are perhaps best illustrated with the use of a specific example. Enterprise resource planning (ERP) systems are rapidly becoming the preferred accounting information system of larger companies (Glover et al. 1999). However, ERP systems pose unique segregation of duties and related data security control issues (Harkness and Green 2004; Lightle and Vallario 2003). To develop a controls testing program in-house would be cost-ineffective in many cases, since it could only be used for that particular company. Not surprisingly, because of their ability to amortize the development costs across many different clients, each of the Big 4 accounting firms has developed its own proprietary testing software designed to address these segregation of duties and data security risks (Lightle and Vallario 2003).[11]

Though many accounting firms and OSPs have developed such programs, there are advantages to having the external auditor provide such services. There is clearly potential for knowledge spillovers into the financial audit for two reasons. First, the external auditor's knowledge of the client's accounting information system and asset structure allows it to assess additional financial reporting risks and risk exposures that might not be apparent to another OSP (Glover et al. 1999). Second, should segregation of duties and/or data security issues arise, they would likely impact the financial statement audit risk assessments as well (Hadden et al. 2003).[12] Furthermore, the external auditor's knowledge of the firm's accounting information systems allows it to more confidently and precisely assess the project's potential risks, testing strategies, and costs—reducing the risk of unexpected or "surprise" budget overruns (Smith 2002; Krishnan and Zhou 1997). Finally, the external auditor's knowledge of client personnel facilitates communication with the client's IA and information systems departments.[13, 14]

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[8] Respondents noted two difficulties in retaining specialized, in-house EDP auditors. First, compensating the EDP specialist may create budget problems—especially if the EDP auditor is not utilizing his/her expertise full-time. Second, if the EDP specialist is more highly compensated, but is not necessarily performing such activities full-time, then other internal auditors may resent the more highly compensated EDP auditor "getting paid more for performing the same work."

[9] These synergies can have two potential benefits. First, there may be an increase in overall audit scope for a fixed budget (Smith 2002; Thomas and Parish 1999). Second, there may be an increase in the external auditor's knowledge of potential audit risks, resulting in a more comprehensive audit program (Aldhizer and Cashell 1996; Simunic 1984).

[10] This contrasts with the results of Caplan and Emby (2004). In particular, routine IA activities are standardized, with little information asymmetry and divergence of opinion regarding the costs. As a results, *both* the Chief Internal Auditor and outsourcer (whether an outside service provider or current external auditor) are more likely to know the expected costs of completing such tasks.

[11] Our sample respondents consistently noted the difficulty in recruiting, training, and retaining EDP auditors, as well as the need for outside, EDP-related expertise and proprietary software.

III. HYPOTHESES

As previously discussed, effective audit committees have an incrementally higher demand for overall audit quality. We hypothesize an effective audit committee's internal and external audit quality demand function diminishes the attractiveness of cost savings and underscores the internal control and independence risks posed by outsourcing routine IA activities. An effective audit committee can accomplish this by voicing its opposition during its review of IA's audit program (Raghunandan et al. 1998, 2001) and/or during its review of nonaudit services provided by the external auditor (Abbott et al. 2003b). As such, we make a directional hypothesis.

> **H1:** The presence of an effective audit committee is negatively related to the degree of outsourcing of routine internal audit activities to the external auditor.

The Treadway Commission (NCFFR 1987) and Raghunandan and McHugh (1994) posit that IA effectiveness is enhanced when IA reports directly to the audit committee. In doing so, the audit committee maintains the independence and organizational status of the IA function, although this effect is diminished when the audit committee itself is not an effective monitor.

This suggests an effective audit committee that has IA employment authority is more likely to shield IA from managerial cost-saving initiatives and is more likely to be apprised of independence issues created by outsourcing routine IA activities (Raghunandan et al. 1998). Accordingly, we hypothesize as follows:

> **H2:** The presence of an effective audit committee that also has joint or sole authority over the chief internal auditor's employment is negatively related to the degree of outsourcing of routine internal audit activities to the external auditor.

As previously discussed, there are several benefits to outsourcing EDP auditing to the external auditor that could lead to an increase in overall audit quality. Furthermore, this type of outsourcing is less likely to negatively affect external auditor independence for two reasons. First, specialized projects may be nonrecurring in nature, reducing the potential to generate economic rents across time (Lightle and Vallario 2003; Glover et al. 1999; Beck et al. 1998; Simunic 1984). Second, due to the transaction costs involved in both searching for a replacement and in the replacement's learning of the client's accounting systems, management termination threats of the external auditor are reduced, thereby increasing external auditor independence (Emby and Davidson 1998).[15] Given these countervailing costs and benefits, we do not provide an *a priori* prediction for the relation between an effective audit committee and outsourcing of these IA activities to the external auditor. Thus, our third hypothesis is given below:[16]

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[12] This becomes evident when noting that ERP systems incorporate the three major duties of an accounting information system: recording, custody, and authorization (Lightle and Vallario 2003).

[13] Sample respondents cited the coordination ease, flexibility, and responsiveness unique to working with the external auditor, often citing "one-stop shopping."

[14] We thank an anonymous reviewer for providing structure to our arguments used in "The Impact of Outsourcing Routine Internal Audit Activities on Audit Quality" and "The Impact of Outsourcing EDP Auditing and Special Projects on Audit Quality" sections.

> **H3:** The presence of an effective audit committee is not associated with the degree of outsourcing of nonroutine (EDP and other specialized) IA operations to the external auditor.

IV. SURVEY AND SAMPLE SELECTION

We mailed the questionnaire provided in the Appendix to the *Fortune* 1000 companies (in terms of total assets) in 1999, per Standard & Poor's Compustat database.[17] While some prior researchers have surveyed chief financial officers or controllers, we directed our survey to the chief internal auditor or alternate party about their IA outsourcing for fiscal year 2000 (preceding significant regulatory constraints). The alternative party was used in cases of 100 percent outsourcing—i.e., there was no in-house chief internal auditor. This first survey was sent in October 2000. A second request was sent in December 2000.

We obtained data related to internal audit outsourcing using survey questions. The two-page survey included the following questions:

1. Did you use any outsourced internal audit services during the past year? (yes/no)
2. Which answer best describes your primary internal audit outside service provider (OSP)? (current external auditor, other CPA firm, other)[18]
3. During the last fiscal year, approximately how many hours were devoted to internal audit services by outside service providers and internal providers?

We also sought information on the types of activities outsourced such as EDP auditing, special projects, and routine internal audit operations (see the Appendix for further details).

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[15] Emby and Davidson (1998) find that external auditors were more likely to insist on disclosures of contingent liabilities when they provided such specialized, nonaudit services to the client.

[16] This particular hypothesis depends in part on whether effective audit committees differentiate between routine and specialized outsourcing IA activities.

[17] The use of a *Fortune* 1000-based sample may limit the generalizability of the results. We chose to impose that limitation in order to increase the likelihood that surveyed firms would have an IA department (Pelfrey and Peacock 1995). We do not believe that this negatively impacts the paper's contribution to the NAS and audit committee literature.

[18] It is possible that in cases of multiple outsourcing providers, respondents may have answered by referring only to their primary service provider, rendering their responses difficult to interpret accurately. We conducted extensive additional analysis that verified that instances of multiple outsourcing providers are extremely rare in our sample and that responses correctly represented all outsourcing activities present. This additional analysis included follow-up phone surveys with those respondents who used outsourcing arrangements (n = 138). This follow-up was designed to elicit whether there had been any instances in which multiple outsourcing providers existed and were not reflected in the response. Within the 90 percent of our sample respondents utilizing outsourcing arrangements that we were able to contact by phone, multiple outsourcing arrangements were extremely rare (less than 10 percent). In each case in which multiple outsourcing providers had been used, the original survey responses accurately described the multi-vendor outsourcing arrangement. As a sensitivity test we deleted the firms we were unable to contact by phone and found results similar to those reported in terms of significance level and sign. We are grateful to an anonymous reviewer for pointing out the potential for misinterpretation.

We received a total of 287 usable responses.[19] Of these usable responses, 219 firms were not banks.[20] Our response rate of approximately 29 percent compares favorably with prior studies (Widener and Selto 1999). The usual procedure in surveys is to use second respondents as proxies for nonrespondents. We performed univariate tests for differences within this population and did not note any significant differences along any of the independent measures examined in this study. In addition, we collected corporate governance data for 100 randomly chosen nonrespondents and compared these firms with our respondents. No significant differences emerged. Table 1 provides details of the industry membership of the 219 usable, non-bank responses, compared to the industry profile of the original population of *Fortune* 1000 companies.

V. RESEARCH DESIGN AND RESULTS

Research Design

We hypothesize that audit committees can appropriately determine the amount, activity, and provider of outsourced internal audit functions. This leads to four different definitions of our dependent variable. Regardless of the dependent variable being utilized, our explanatory variables remain constant. Our model—with a generic dependent variable—is given below:

TABLE 1
Sample Selection Results

Focus Industry	Related Two-Digit SIC Codes	# of Sample Firms	% of Sample	# of *Fortune* 1000 Firms	% of *Fortune* 1000 Firms
Construction	15–17	4	1.8	6	0.6
Consumer Product and Food	20–33	47	21.5	166	16.6
Energy	10–14, 46, 49	34	15.6	130	13.0
Financial Services	60–64, 67	42[a]	19.3	335	33.5
Information and Communication	48, 73, 78, 79, 84	29	13.2	96	9.6
Manufacturing	34–39	28	12.8	122	12.2
Personal Services and Healthcare	72, 80, 83	4	1.8	12	1.2
Professional, Commercial Services, Education	75, 76, 82, 87, 89	2	0.9	10	1.0
Real Estate	65, 70	1	0.4	6	0.6
Retail and Wholesale	50–59	21	9.9	82	8.2
Transportation	40–42, 44, 45, 47	7	3.2	35	3.5
All Other	1, 2,7, 8, 99	0	0.0	0	0.0
Totals		219	100.4[b]	1,000	100.0

[a] Firms included in this segment are from the insurance industry and non-bank financial services industry (i.e., brokerage houses, etc.). Sample does not include banks and other financial institutions that face additional regulation unique to their industry.
[b] Exceeds 100% due to rounding.

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[19] Two survey responses were returned with the corresponding control numbers deleted and these two responses were discarded.

[20] We do include 42 non-banking firms in the financial services sector, although our primary results are not sensitive to their exclusion.

$$\begin{aligned} DV = {} & b_0 + b_1 \mathrm{LN}(ASSETS) + b_2 RDSALES + b_3 TROUBLE + b_4 RECINV \\ & + b_5 RISKIND + b_6 ASSTGROW + b_7 ROA + b_8 FORSALES\% \\ & + b_9 GOVRNK + b_{10} ACE + b_{11} AUTHORITY + b_{12} ACE{*}AUTHORITY + \varepsilon \end{aligned}$$

where:

DV = dependent variable reflecting various types of outsourcing;
LN(*ASSETS*) = natural log of total assets (in billions);
RDSALES = R&D expenditures as a percentage of sales;
TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years;
RECINV = accounts receivable and inventory as a percentage of total assets;
RISKIND = dichotomous variable coded 1 in cases where company is classified in SIC codes 283x, 357x, 360x-367x, 737x, and 873x;
ASSTGROW = three-year realized growth rate of total assets measured from 1998 to 2000, compounded annually;
ROA = return on assets;
FORSALES% = foreign sales as a percentage of overall sales;
GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC*(*GOV*) scores;
ACE = dichotomous variable coded 1 for audit committees composed entirely of independent directors, containing at least one member with financial expertise, and that meet at least four times annually; and
AUTHORITY = dichotomous variable coded 1 if the audit committee has either joint or sole authorization to dismiss the chief internal auditor (survey question #11).

As previously mentioned, we posit that effective audit committees influence the amounts, provider, and type of IA activities being outsourced. Therefore, our main tests employ four different dependent variable definitions, contingent upon the amount, provider, and nature of activities being outsourced. In order to determine the amount of activities being outsourced, we define an intermediate variable *OUTAUD%*, which is the amount of externally provided internal audit hours (provided by either the current external auditor or an outside service provider) as a percentage of *total* internal audit hours (both in- and outsourced) per survey question #3. We then multiply *OUTAUD%* by four other variables representing the permutations of provider and nature of IA activities being outsourced. Table 2 summarizes the different permutations and resultant dependent variable definitions. Our primary focus is on the upper left quadrant of the table.

One other item merits discussion before proceeding. In cases where our dependent variable concerns the external auditor (outside service provider), amounts outsourced to the outside service provider (external auditor) are treated as zero values. As such, our main tests are Tobit regressions since many observations will be truncated at zero.

TABLE 2
Outsourcing Choices

Outsourcing Provider	**Nature of IA Activities Outsourced**	
	Recurring IA Activities	**Nonrecurring IA Activities**
Current External Auditor	*OUTAUD%*AUDRTMIX%* Percentage of internal audit budget provided by external auditor multiplied by the proportion of those activities that are routine in nature	*OUTAUD%*AUDNRMIX%* Percentage of internal audit budget provided by external auditor multiplied by the proportion of those activities that are nonroutine in nature
Outside Service Provider	*OUTAUD%*OSPRTMIX%* Percentage of internal audit budget provided by outside service provider multiplied by the proportion of those activities that are routine in nature	*OUTAUD%*OSPNRMIX%* Percentage of internal audit budget provided by outside service provider multiplied by the proportion of those activities that are nonroutine in nature

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of *total* internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);
AUDRTMIX% = the proportion of outsourced internal audit activities to the external auditor that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions, and/or internal control evaluation);
AUDNRMIX% = the proportion of outsourced internal audit activities to the external auditor that are nonroutine in nature (defined as EDP auditing, special consulting projects);
OSPRTMIX% = the proportion of outsourced internal audit activities to the outside service provider that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions, and/or internal control evaluation); and
OSPNRMIX% = the proportion of outsourced internal audit activities to the outside service provider that are nonroutine in nature (defined as EDP auditing, special consulting projects) per survey question #6.

Control and Test Variables

Control Variables

Prior empirical outsourcing research is fairly limited. Our research design follows primarily from the works of Widener and Selto (1999) and Caplan and Kirschenheiter (2000). Widener and Selto (1999) document statistically significant positive relations between the level of outsourcing and proxies for audit frequency and asset specificity. We measure the need for frequent, recurring in-house audits by using company size (*ASSETS*). Our proxy for asset specificity is research and development expenditures as a percentage of sales (*RDSALES*).

Caplan and Kirschenheiter (2000) present an internal audit outsourcing model using an agency perspective. They note that the penalty structures and the reservation wage of an external provider differ from those of an in-house internal auditor. Their analytical models indicate that the incentives to outsource "generally increase in risk, including the risk that a control weakness exists and the size of the loss that can result from an undetected control weaknesses" (Caplan and Kirschenheiter 2000, 411). We currently utilize three audit risk proxies in our analyses: deteriorating financial condition (*TROUBLE*), asset composition (*RECINV*), and membership in a high-litigation industry (*RISKIND*).[21]

The Caplan and Kirschenheiter (2000) model also highlights the need for strong internal controls. Beasley (1996) posits that firms undergoing rapid growth may have an internal control structure that inadequately captures the firm's increase in transactions and complexity. Consequently, we also proxy for the potential for obsolescence in internal controls with the three-year rate of realized asset growth, *ASSTGROW*.

We augment our model with two other explanatory variables. First, Petravick (1997) and Pelfrey and Peacock (1995) document that cost savings are an important consideration in the outsourcing decision. Our proxy for the desire for cost savings is a profitability measure, return on assets (*ROA*). Second, the IIA (1996) notes that outsourcers enjoy economies of scale and that such economies of scale take on added importance as a firm becomes more international (Pelfrey and Peacock 1995). Our proxy for the level of internationalization is foreign sales as a percentage of total sales (*FORSALES%*).

Finally, some prior studies find overall corporate governance factors may explain certain financial reporting outcomes that relate to audit committee duties (DeFond et al. 2005; Beasley 1996). To control for this, we include an overall corporate governance variable (*GOVRNK*). In determining an overall corporate governance score, prior research has yet to agree upon a single, consensus corporate governance measure (DeFond et al. 2005; Gompers et al. 2003). Our approach is to perform factor analysis on five pervasive corporate governance measures found in prior research: percentage of independent directors (Beasley 1996), board size (Yermack 1996), inside ownership (Morck et al. 1988), CEO/Chairman duality (Goyal and Park 2002), and outside blockholdings (Abbott et al. 2003b).[22] Based upon factor analysis scores, sample firms were placed into deciles and the resultant decile score (*GOVRNK*) was used in our univariate and multivariate tests.

Test Variables

As described previously, prior research has consistently identified a set of common attributes of effective audit committees, including independence, expertise, and activity. SOX calls for audit committees composed entirely of independent directors.[23] Moreover, SOX recommends that at least one member of the audit committee exhibit financial expertise.[24] Finally, prior research posits that an audit committee's ability to perform its duties is likely a function of the desire to do so (DeZoort et al. 2002; Kalbers and Fogarty 1993). The Blue Ribbon Committee on Improving the Effectiveness of Audit Committees (BRC 1999), as well as the National Association of Corporate Directors (NACD 1999), suggests that in order for an audit committee to be properly apprised of current auditing issues, it should meet at least four times annually. Thus, our *ACE* variable is dichotomously coded 1 in instances where the audit committee is composed entirely of independent directors, contains at least one member with financial expertise, *and* meets at least four times annually. Such data are collected from the firm's annual proxy statement.

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[21] These factors are chosen because prior research has documented that these are the three most important publicly observable factors that influence auditors' perceptions about the risk associated with an audit client (Pratt and Stice 1994).

[22] All measures were hand-collected via sample firms' proxy statements, including information on the total number of audit committee meetings.

[23] For each director serving on the audit committee during 2000, we determine, consistent with SOX, whether the director was a current or former employee of the firm (acceptable under NASDAQ and AMEX regulations during the sample period) or had any other disclosed affiliation with the company or its management, other than board service. If any director on the audit committee has such a relationship, then the audit committee fails to meet our independence definition.

[24] The BRC (1999) recommends that at least one audit committee member possesses financial expertise. Unlike SOX, the BRC provides specific examples of experiences that fulfill such a trait. Consistent with the BRC, we define an audit committee as having a financial expert if at least one director is (or has been) a CPA, investment banker or venture capitalist, served as CFO or controller, or has held a senior management position (CEO, President, EVP, SVP, VP) with financial responsibilities.

Our second test variable (*AUTHORITY*) measures whether the survey response indicates that the audit committee has sole or shared authority for dismissal of the chief internal auditor. This factor is a measure of the institutional power and recognition of the IA function, and of the alignment between IA and the audit committee. Our second hypothesis pertains directly to the interactive term (*ACE*AUTHORITY*) since we believe dismissal authority enhances an *effective* audit committee's ability to influence the outsourcing decision, but not so for an ineffective audit committee. *AUTHORITY* is also used as a standalone variable in our regressions to determine if such a reporting arrangement affects the outsourcing decision by itself.

Descriptive Data

Table 3 presents descriptive data about our dependent and independent variables. Panels A, B, and C document descriptive statistics for the 75, 63, and 81 firms which (1) outsourced to the current external auditor, (2) outsourced to an outside service provider and (3) did not outsource IA functions, respectively. In contrast to Widener and Selto (1999), well over half (138 or approximately 63 percent) of our sample firms outsourced a portion of the IA function. Of the 75 (63) firms outsourcing to the external auditor (OSP), there were no (2) sample firms that used multiple outsource providers.[25] This may be indicative of a discrete choice function and may speak to the difficulty in coordinating outsourcing efforts amongst multiple vendors.

The mean (median) percentage of IA outsourcing (*OUTAUD%*) is 32.2 percent (17.8 percent) for those firms outsourcing to the current external auditor. For sample firms using an OSP, the mean (median) percentage of IA outsourcing was 27.7 percent (9.9 percent). For purposes of comparison, Widener and Selto (1999) find that only about 29 percent of their sample (24/83) outsourced *any* IA activities. Moreover, the mean percentage of outsourced IA activities for Widener and Selto (1999) was only 10.0 percent, with a median of 5.3 percent. Our results suggest a substantial increase in the outsourcing phenomenon as posited by Rittenberg and Covaleski (2001).

Next, we note the distribution between the relative amounts of routine IA activities (*AUDRTMIX%*) versus nonroutine IA activities (*AUDNRMIX%*) being outsourced. We used answers to survey question #6 to categorize outsourced activities into either routine or nonroutine. EDP auditing or specialized consulting projects were classified as nonroutine outsourced activities, the remainder (financial statement audits of subsidiaries, internal control evaluations, routine IA functions) was classified as routine. For outsourcing to the external auditor, the mean (median) percentage of outsourcing relating to routine IA activities was 36 percent (40 percent), per Panel A of Table 3. Thus, for our median external auditor outsourcing firm, 40 percent of those IA activities that were outsourced were routine in nature and the remainder were specialized in nature. For those firms using an OSP, the mean (median) percentage of outsourcing relating to routine IA activities was 62 (60) percent per Panel B of Table 3.

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[25] The two respondents using multiple outsourcing providers stated they used another Big 4 audit firm, in combination with local CPA firms with large presences in Germany and Malaysia, respectively.

TABLE 3
Descriptive Data

Variable	Mean	Median	25th %	75th %	Min.	Max.	Std. Dev.
Panel A: Descriptive Statistics for 75 Firms Outsourcing to Current External Auditor							
OUTAUD%	0.322	0.178	0.099	0.433	0.433	1.000	0.212
AUDRTMIX%	0.357	0.400	0.700	0.200	0.000	1.000	0.192
AUDNRMIX%	0.643	0.600	0.300	0.800	0.000	1.000	0.199
ACE	0.250	0.000	1.000	0.000	0.000	1.000	0.433
AUTHORITY	0.600	1.000	0.000	1.000	0.000	1.000	0.489
AC independ	0.373	0.000	1.000	1.000	0.000	1.000	0.483
AC meets	0.588	1.000	0.000	1.000	0.000	1.000	0.492
AC expertise	0.701	1.000	0.000	1.000	0.000	1.000	0.457
ASSETS	16.231	6.304	3.101	13.033	3.274	386.684	47.147
RDSALES	0.008	0.000	0.000	0.004	0.000	0.141	0.021
TROUBLE	0.073	0.000	0.000	0.000	0.000	1.000	0.260
RECINV	0.262	0.178	0.081	0.344	0.052	0.877	0.235
RISKIND	0.058	0.000	0.000	0.000	0.000	1.000	0.233
ASSTGROW	11.099	7.936	1.225	19.342	−18.734	71.732	16.751
ROA	0.033	0.032	0.016	0.058	−0.113	0.162	0.039
FORSALES%	0.114	0.000	0.000	0.197	0.000	0.662	0.175
GOVRNK	4.899	4.000	2.000	7.000	1.000	10.000	2.117
Panel B: Descriptive Statistics for 63 Firms Outsourcing to Outside Service Provider							
OUTAUD%	0.277	0.099	0.033	0.499	0.022	1.000	0.302
OSPRTMIX%	0.620	0.600	0.450	0.900	0.050	0.950	0.185
OSPNRMIX%	0.380	0.400	0.550	0.100	0.050	0.950	0.201
ACE	0.603	1.000	0.000	1.000	0.000	1.000	0.489
AUTHORITY	0.833	1.000	1.000	1.000	0.000	1.000	0.372
AC independ	0.591	1.000	0.000	1.000	0.000	1.000	0.491
AC meets	0.603	1.000	0.000	1.000	0.000	1.000	0.489
AC expertise	0.863	1.000	0.000	1.000	0.000	1.000	0.343
ASSETS	11.149	5.311	3.581	13.372	5.311	148.789	20.415
RDSALES	0.009	0.000	0.000	0.005	0.000	0.164	0.024
TROUBLE	0.076	0.000	0.000	0.000	0.000	1.000	0.264
RECINV	0.222	0.203	0.083	0.299	0.044	0.845	0.188
RISKIND	0.063	0.000	0.000	0.000	0.000	1.000	0.242
ASSTGROW	10.793	6.875	0.889	13.904	−4.994	60.415	14.042
ROA	0.039	0.031	0.010	0.049	−0.084	0.482	0.069
FORSALES%	0.121	0.000	0.000	0.110	0.000	0.776	0.173
GOVRNK	5.255	5.000	3.000	8.000	1.000	10.000	2.006
Panel C: Descriptive Statistics for 81 Firms That Did Not Outsource							
ACE	0.550	1.000	0.000	1.000	0.000	1.000	0.497
AUTHORITY	0.766	1.000	1.000	1.000	0.000	1.000	0.423
AC independ	0.607	1.000	0.000	1.000	0.000	1.000	0.488

(continued on next page)

TABLE 3 (continued)

Variable	Mean	Median	25th %	75th %	Min.	Max.	Std. Dev.
AC meets	0.627	1.000	0.000	1.000	0.000	1.000	0.484
AC expertise	0.857	1.000	0.000	1.000	0.000	1.000	0.350
ASSETS	11.681	5.728	3.010	13.039	4.005	167.051	21.953
RDSALES	0.012	0.000	0.000	0.009	0.000	0.228	0.027
TROUBLE	0.037	0.000	0.000	0.000	0.000	1.000	0.223
RECINV	0.241	0.208	0.074	0.369	0.032	0.856	0.189
RISKIND	0.068	0.000	0.000	0.000	0.000	1.000	0.252
ASSTGROW	6.965	3.975	0.015	13.422	−28.754	173.584	21.512
ROA	0.035	0.029	0.011	0.058	−0.189	0.217	0.054
FORSALES%	0.084	0.000	0.000	0.095	0.000	0.684	0.181
GOVRNK	4.895	5.000	2.000	7.000	1.000	10.000	2.197

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of *total* internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);

AUDRTMIX% = the proportion of outsourced internal audit activities to the external auditor that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions, and/or internal control evaluation);

AUDNRMIX% = the proportion of outsourced internal audit activities to the external auditor that are nonroutine in nature (defined as EDP auditing, special consulting projects);

OSPRTMIX% = the proportion of outsourced internal audit activities to the outside service provider that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions, and/or internal control evaluation);

OSPNRMIX% = the proportion of outsourced internal audit activities to the outside service provider that are nonroutine in nature (defined as EDP auditing, special consulting projects) per survey question #6;

ACE = audit committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0;

AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0;

AC independ = 1 for audit committees comprised entirely of independent directors, else 0;

AC meets = a dichotomous variable coded 1 for audit committees that meet at least four times annually, else 0;

AC expertise = 1 for audit committees containing at least one director with financial expertise, else 0;

ASSETS = total assets (in billions) (Compustat Item #6);

RDSALES = research and development expenditures as a percentage of total sales (Compustat Item #46/Item #12);

TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years (Compustat Item #18);

RECINV = accounts receivable and inventory as a percentage of total assets ((Compustat Items #2 + #3)/Item #6);

RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;

ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;

ROA = return on assets (Compustat Item #18/Item #6);

FORSALES% = foreign sales as a percentage of total sales (Compustat segment file); and

GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; Firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC(GOV)* scores.

Univariate Tests

Table 4 provides three sets of univariate analyses. Panel A of Table 4 presents the results of a Mann-Whitney test for differences between the firms outsourcing to the external auditor, those outsourcing to another OSP, and those that do not outsource. Companies that outsourced IA to the external auditor were less likely to (1) have an effective audit committee (*ACE*) and (2) have an audit committee with authority over internal auditor dismissal (*AUTHORITY*) versus both those outsourcing to another OSP and those that do not outsource. When we break down the components of the *ACE* variable, we find that the significant differences in *ACE* appear related to audit committee independence and expertise, but not to number of meetings.

With respect to control variables, significant differences were found between firms outsourcing to the external auditor versus no outsourcing. Firms outsourcing IA activities to the external auditor were (1) less R&D intense (*R&DSALES*), (2) more likely to experience financial distress (*TROUBLE*), (3) faster growing (*ASSTGROW*), and (4) more international in scope (*FORSALES%*) than non-outsourcers. However, there were no significant differences in control variables between firms outsourcing to another OSP and firms outsourcing to the external auditor.

When comparing firms that outsourced to an OSP (excluding external auditors) with those firms that did not outsource, the statistically significant differences largely mirrored those of the prior comparison (i.e., external auditor outsourcers versus non-outsourcers) with the exception of our test variables, which are not significantly different. Panels B and C of Table 4 present results for Chi-square tests for differences in our test variables for firms outsourcing to the external auditor versus those either not outsourcing, or outsourcing to another OSP. The tests indicate significant differences between the two samples, in terms of two of our test variables, *ACE* and *ACE*AUTHORITY*.

Regression Analyses

Our first regression analysis, shown in Table 5, is a logit regression relating the outsourcing of any internal audit activities (*OUTAUD%*) to the test and control variables. The results are consistent with a significant negative relation (parameter estimate = −1.281, Chi-square = 12.202) between *ACE* and the decision to outsource any internal audit tasks to the external auditor. We find this effect is heightened when an effective audit committee has dismissal authority over the CIA (*ACE*AUTHORITY* is negative and significant at the 1 percent level).[26] These results form the basis for further tests.

Table 6 provides the results of further analysis, relating the proportion of outsourcing of routine and nonroutine tasks to the control and test variables, using a Tobit framework. The Tobit approach is a more appropriate one for a dependent variable with a truncated distribution with a large number of zero-valued observations. In Model 1, our dependent variable is the proportion of overall internal audit activities outsourced to the external auditor (*AUDRTMIX%*OUTAUD%*) that are routine in nature. It is this particular type of outsourcing that is most deleterious to internal and external audit independence. The coefficient estimates for our test variables, *ACE* (parameter estimate = −1.599) and *ACE*AUTHORITY* (parameter estimate = −0.429), are also in the predicted negative direction and highly significant (one-tailed $p < 0.01$). These results support H1 and H2.

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[26] In accordance with a reviewer's suggestion, we also ran our statistical tests using differential coding for those audit committees with joint versus sole authority over the employment of the internal auditor. The results are qualitatively similar (though at higher significance levels) when the committee has sole authority.

TABLE 4
Univariate Analysis

Panel A: Mann-Whitney Tests for Differences in Means between Subsamples

Variable Name	Ext. Audit Outsource Mean (Column A)	OSP Outsource Mean (Column B)	No Outsource Mean (Column C)	Column A – Column B	Column A – Column C	Column B – Column C
ASSETS	16.231	11.149	11.681	5.082	4.550	−0.532
RDSALES	0.008	0.009	0.012	−0.001	−0.004*	−0.003*
TROUBLE	0.073	0.076	0.037	−0.003	0.036**	0.039**
RECINV	0.262	0.222	0.241	0.040	0.021	−0.019
RISKIND	0.058	0.063	0.068	−0.005	−0.010	−0.005
ASSTGROW	11.099	10.793	6.965	0.306	4.134**	3.828**
ROA	0.033	0.039	0.035	−0.006	−0.002	0.004
FORSALES%	0.114	0.121	0.084	−0.007	0.030*	0.037*
GOVRNK	4.899	5.255	4.895	−0.356	0.004	0.360
ACE	0.250	0.603	0.555	−0.355**	−0.305**	0.048
AUTHORITY	0.600	0.833	0.766	−0.233**	−0.166**	0.067
AC independ	0.373	0.591	0.607	−0.218**	−0.234**	−0.016
AC meets	0.588	0.603	0.627	−0.015	−0.039	−0.024
AC expertise	0.701	0.863	0.857	−0.156**	−0.162**	0.006
Sample firms	75	63	81	NA	NA	NA

Panel B: Chi-Square Tests for Differences in *ACE*

ACE Value	Firms Outsourcing to External Auditor	Firms Not Outsourcing to External Auditor	Totals
ACE = 0	56	61	117
ACE = 1	19	83	102
Totals	75	144	χ^2 statistic = 10.55**

Panel C: Chi-Square Tests for Differences in *ACE*AUTHORITY*

*ACE*AUTHORITY*	Firms Outsourcing to External Auditor	Firms Not Outsourcing to External Auditor	Totals
*ACE*AUTHORITY* = 0	69	81	150
*ACE*AUTHORITY* = 1	6	63	69
Totals	75	144	χ^2 statistic = 6.975**

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*, ** Significance levels at .05 and .01, respectively.

ASSETS = total assets (in billions) (Compustat Item #6);

RDSALES = research and development expenditures as a percentage of total sales (Compustat Item #46/Item #12);

TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years (Compustat item #18);

RECINV = accounts receivable and inventory as a percentage of total assets ((Compustat Items #2 + #3)/ Item #6);

RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;

ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;

(*continued on next page*)

TABLE 4 (continued)

ROA = return on assets (Compustat Item #18/Item #6);
FORSALES% = foreign sales as a percentage of total sales, (Compustat Segment File);
GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC(GOV)* scores;
ACE = audit committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0;
AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0;
AC independ = 1 for audit committees comprised entirely of independent directors, else 0;
AC meets = a dichotomous variable coded 1 for audit committees that meet at least four times annually, else 0; and
AC expertise = 1 for audit committees containing at least one director with financial expertise, else 0.

The coefficient estimates for our *TROUBLE* and *ASSTGROW* variables are in the predicted direction and statistically significant. This evidence provides some empirical support for the Caplan and Kirschenheiter (2000) model. In particular, companies that are in worse financial condition or are faster growing are more likely to outsource routine internal audit functions to the external auditor. Finally, we also find that less profitable firms (*ROA*) or firms with a higher proportion of foreign sales (*FORSALES%*) are more likely to outsource routine internal auditing to the external auditor. Our measure of board level governance characteristics (*GOVRNK*) was not significant.

Table 6, model 2 uses as its dependent variable the percentage of IA activities outsourced to the external auditor that are nonroutine and thus likely to be nonrecurring (e.g., EDP auditing and/or special consulting projects). Such outsourcing is less likely to threaten the organizational status of the internal auditors or to impair external audit independence, while improving audit effectiveness by providing specialized expertise. We find that the relation between our test variables and the portion of outsourcing of these types of functions is insignificant. The insignificant relation may reflect the audit committee's countervailing motives for increased audit quality versus a desire to maintain external auditor independence in appearance (Abbott et al. 2003b).

Interestingly, the coefficient estimate on our *ROA* variable in model 2 is no longer significant, suggesting that cost-savings are an outsourcing consideration only for routine internal audit activities. This finding provides indirect support for the evidence provided by Caplan and Emby (2004). The coefficient estimates for *TROUBLE*, *ASSTGROW*, and *FORSALES%* (−2.054, 2.002, and 2.221, respectively) remain significant and suggest that financial condition, growth and international scope are key determinants in the outsourcing decision. We again fail to document a statistically significant relation for client size (*ASSETS*), R&D intensity (*RDSALES*), or industry risk (*RISKIND*).

Finally, our *RECINV* coefficient estimate is positive (parameter estimate = 1.995) and significant, suggesting that as a firm's underlying accounting transactions are more complex, there may be a greater need for external auditor EDP expertise. This result, combined with the lack of significance for this variable in the recurring internal audit activities regression, supports arguments advanced by Krishnan and Zhou (1997). In particular, chief internal auditors likely have the knowledge to accurately assess the amount of audit effort required to complete routine internal audit activities, but do not have such knowledge for specialized EDP-related activities.

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TABLE 5
Logistic Regression Results
Binary Use External Auditor Outsourcing

$$
\begin{aligned}
OUTAUD\% = {} & b_0 + b_1\mathrm{LN}(ASSETS) + b_2 RDSALES + b_3 TROUBLE + b_4 RECINV \\
& + b_5 RISKIND + b_6 ASSTGROW + b_7 ROA + b_8 FORSALES\% + b_9 GOVRNK \\
& + b_{10} ACE + b_{11} AUTHORITY + b_{12} ACE{*}AUTHORITY + \varepsilon
\end{aligned}
$$

Independent Variable	Expected Sign	Parameter Estimate	Chi-Square Statistic
Intercept	?	−2.437	3.367
LN(*ASSETS*)	+	0.219	0.147
RDSALES	−	−1.030	0.799
TROUBLE	+	0.438	4.225*
RECINV	+	0.451	1.012
RISKIND	+	−0.323	0.687
ASSTGROW	+	0.156	1.002
ROA	−	−0.352	0.524
FORSALES%	+	0.631	4.031*
GOVRNK	−	−0.241	0.788
ACE	−	−1.281	12.202**
AUTHORITY	−	−0.308	0.543
*ACE*AUTHORITY*	−	−0.622	7.885**
Observations	219		Pseudo $R^2 = 0.115$

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*, ** Differences are significant at p-levels of less than 0.05 and 0.01, respectively.

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of *total* internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);
ASSETS = total assets (in billions) (Compustat Item #6);
RDSALES = research and development expenditures as a percentage of total sales (Compustat Item #46/Item #12);
TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years (Compustat Item #18);
RECINV = accounts receivable and inventory as a percentage of total assets ((Compustat Items #2 + #3)/Item #6);
RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;
ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;
ROA = return on assets (Compustat Item #18/Item #6);
FORSALES% = foreign sales as a percentage of total sales (Compustat Segment File);
GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC*(*GOV*) scores;
ACE = audit committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0; and
AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0.

Overall, the results of Table 6 are consistent with effective audit committees constraining detrimental internal audit outsourcing. These results suggest that effective audit

TABLE 6
Tobit Regression Results
Outsourcing Activities to Current External Auditor

$$\begin{aligned} \mathit{AUDMIX\%{*}OUTAUD\%} = {} & b_0 + b_1\mathrm{LN}(\mathit{ASSETS}) + b_2\mathit{RDSALES} + b_3\mathit{TROUBLE} \\ & + b_4\mathit{RECINV} + b_5\mathit{RISKIND} + b_6\mathit{ASSTGROW} + b_7\mathit{ROA} \\ & + b_8\mathit{FORSALES\%} + b_9\mathit{GOVRNK} + b_{10}\mathit{ACE} \\ & + b_{11}\mathit{AUTHORITY} + b_{12}\mathit{ACE{*}AUTHORITY} + \varepsilon \end{aligned}$$

		Model 1 Dependent Variable *AUDRTMIX%*OUTAUD%*		Model 2 Dependent Variable *AUDNRMIX%*OUTAUD%*	
Independent Variable	**Expected Sign**	**Parameter Estimate**	**t-statistic**	**Parameter Estimate**	**t-statistic**
Intercept	?	−2.251	−2.222	−5.667	−3.457
LN(*ASSETS*)	+	0.778	0.565	0.098	0.551
RDSALES	−	−2.347	−1.099	−2.054	−0.905
TROUBLE	+	3.779	2.479**	5.002	2.814**
RECINV	+	0.957	0.712	1.995	2.067*
RISKIND	+	0.874	1.003	0.390	0.496
ASSTGROW	+	1.108	2.667**	2.002	3.006**
ROA	−	−3.501	−1.774*	−2.158	−1.115
FORSALES%	+	3.722	1.871*	2.221	1.831*
GOVRNK	−	−5.198	−0.704	−4.552	−0.649
ACE	−	−1.599	−4.224**	−0.774	−0.745
AUTHORITY	−	2.444	0.011	1.077	0.198
*ACE*AUTHORITY*	−	−0.429	−3.011**	−0.816	−1.013
Observations		219		219	
Pseudo R^2		0.152		0.117	

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*, ** Differences are significant at two-sided (one-sided if in predicted direction) p-levels of less than 0.05 and 0.01, respectively.

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of *total* internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);

AUDRTMIX% = the proportion of outsourced internal audit activities to the external auditor that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions and/or internal control evaluation);

AUDNRMIX% = the proportion of outsourced internal audit activities to the external auditor that are nonroutine in nature (defined as EDP auditing, special consulting projects);

ASSETS = total assets (in billions) (Compustat Item #6);

RDSALES = research and development expenditures as a percentage of total sales (Compustat item #46/ item #12);

TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years; (Compustat item #18);

RECINV = accounts receivable and inventory as a percentage of total assets; ((Compustat Items #2 + #3)/Item #6);

RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;

ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;

ROA = return on assets (Compustat Item #18/Item #6);

FORSALES% = foreign sales as a percentage of total sales (Compustat Segment File);

(*continued on next page*)

TABLE 6 (continued)

GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC(GOV)* scores;
ACE = audit committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0; and
AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0.

committees can and do distinguish between types of outsourcing activities.

Multivariate Results—Outsourcing to an Outside Service Provider

Our hypotheses assume that an effective audit committee can not only distinguish between the types of outsourcing activities, but also between outsourcing providers. In particular, outsourcing to an OSP is much less likely to threaten internal audit independence since such arrangements almost invariably have the OSP report directly to the in-house CIA (Serafini et al. 2003).[27] Obviously, such an arrangement would have little, if any, impact on external auditor independence. However, to test the robustness of our results reported in Table 6 with respect to the type of provider, we conduct regressions where the dependent variable is defined as the percentage of outsourcing to an OSP, other than the external auditor. As in our previous multivariate tests, we further decompose our dependent variable into routine versus nonroutine outsourcing percentages, and utilize a Tobit model, since those firms which outsourced to the current external auditor and those who do not outsource have a value of zero for the dependent variable.

Table 7, model 1, presents our regression results utilizing a dependent variable defined as the percentage of routine IA activities outsourced to an outside service provider (excluding the external auditor). Our coefficient estimates for our two test variables are insignificant. Combined with the results from Table 4, the results suggest that effective audit committees not only distinguish between the types of activities outsourced, but also the type of provider, even after controlling for other determinants of the outsourcing demand. Interestingly, we find a negative and significant relation (parameter estimate = −2.289, 5 percent significance level) between the percentage of routine internal audit activities outsourced to an outside service provider and R&D intensity. This suggests that those internal audit activities that could present client confidentiality concerns are less likely to be outsourced to an outside party. Such a result is consistent with evidence provided by Widener and Selto (1999). Growth, financial distress, and internationalization are all positively related to the proportion of routine activities outsourced to the OSP.

Table 7, model 2, presents our regression results utilizing a dependent variable defined as the percentage of nonroutine internal audit activities outsourced to an outside service provider. Our coefficient estimates for our two test variables are insignificant, as are coefficient estimates for *ROA*, *RISKIND*, *RECINV*, and *ASSETS*. As in prior regressions, our *RDSALES*, *FORSALES%*, *TROUBLE*, and *ASSTGROW* variables are statistically significant and in the predicted direction.

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[27] We document that approximately 4 percent (nine of 219 firms) of our sample respondents outsourced their entire internal audit function. Of these nine firms, six were outsourced to the external auditor and the other three were to an outside service provider. Thus, outsourcing entire internal audit functions is rare and most likely involves the external auditor.

TABLE 7
Tobit Regression Results
Outsourcing Activities to other Outside Service Provider

$$\begin{aligned} \mathit{OSPMIX\%{*}OUTAUD\%} = {} & b_0 + b_1\mathrm{LN}(\mathit{ASSETS}) + b_2\mathit{RDSALES} + b_3\mathit{TROUBLE} \\ & + b_4\mathit{RECINV} + b_5\mathit{RISKIND} + b_6\mathit{ASSTGROW} + b_7\mathit{ROA} \\ & + b_8\mathit{FORSALES\%} + b_9\mathit{GOVRNK} + b_{10}\mathit{ACE} \\ & + b_{11}\mathit{AUTHORITY} + b_{12}\mathit{ACE{*}AUTHORITY} + \varepsilon \end{aligned}$$

		Model 1 Dependent Variable _OSPRTMIX%*OUTAUD%_		**Model 2 Dependent Variable** _OSPNRMIX%*OUTAUD%_	
Independent Variable	**Expected Sign**	**Parameter Estimate**	**t-statistic**	**Parameter Estimate**	**t-statistic**
Intercept	?	−3.773	−2.222	−2.853	−0.888
LN(_ASSETS_)	+	−0.452	−1.005	2.724	0.845
RDSALES	−	−2.289	−2.007*	−1.082	−2.777**
TROUBLE	+	4.115	2.432**	3.271	2.682**
RECINV	+	2.664	1.012	1.076	0.597
RISKIND	+	−0.344	−0.487	−0.898	−1.002
ASSTGROW	+	0.225	2.053*	0.847	2.428**
ROA	−	−1.477	−0.772	−3.729	−0.903
FORSALES%	+	2.555	1.773*	2.007	1.745*
GOVRNK	−	−0.119	−0.547	−0.295	−0.654
ACE	−	0.998	−0.568	−0.111	−0.815
AUTHORITY	−	−1.554	−0.089	−0.008	−0.221
ACE*AUTHORITY	−	−0.112	−1.012	−0.052	−0.678
Observations		219		219	
Pseudo R^2		0.1137		0.1358	

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*, ** Differences are significant at two-sided (one-sided if in predicted direction) p-levels of less than 0.05 and 0.01, respectively.

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of _total_ internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);

OSPRTMIX% = the proportion of outsourced internal audit activities to the outside service provider that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions and/or internal control evaluation);

OSPNRMIX% = the proportion of outsourced internal audit activities to the outside service provider that are nonroutine in nature (defined as EDP auditing, special consulting projects) per survey question #6;

ASSETS = total assets (in billions) (Compustat Item #6);

RDSALES = research and development expenditures as a percentage of total sales (Compustat Item #46/ Item #12);

TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years; (Compustat Item #18);

RECINV = accounts receivable and inventory as a percentage of total assets ((Compustat Items #2 + #3)/ Item #6);

RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;

ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;

ROA = return on assets (Compustat Item #18/Item #6);

(_continued on next page_)

TABLE 7 (continued)

FORSALES% = foreign sales as a percentage of total sales (Compustat Segment File);
GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC(GOV)* scores;
ACE = audit committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0; and
AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0.

Finally, as a sensitivity test, Table 8 shows an OLS regression of the proportion of routine IA activities outsourced to the external auditor, within the subsample of respondents that outsource to the external auditor. This proportion is negatively, significantly related to our test variable *ACE* (parameter estimate = −1.112, t statistic = −5.355) and the interaction term *ACE*AUTHORITY* (parameter estimate = −0.639, t statistic = −3.652). This suggests that within the group that decided to outsource to the external auditor, the audit committee continues to monitor the type of outsourcing taking place.

Sensitivity Analyses

Integral to our study is the degree to which an audit committee can influence the outsourcing decision. To test this assumption directly we begin by examining whether effective audit committees (per our definition) are more involved with internal audit (i.e., have a higher level of interaction). Following Raghunandan et al. (2001), we examine the determinants of whether the audit committee reviewed IA proposals related to programs/plans and budgets (question #9), as well as results related to financial reporting, internal control, and compliance with laws/regulations (also question #9). We do so using the following regression framework:

Interaction = f(*Size*, *Leverage*, *Exchange*, *Inown*, *ACE*, *Privacy*, *Privacy*ACE*, *IADISC*)

where:

Interaction = dependent variable coded 1 in instances where the audit committee performed all of the following duties: reviewed internal audit proposals related to programs/plans, budgets, coordination with external auditors, as well as reviewed internal auditing results pertaining to financial reporting, internal control, and compliance with laws and regulations (per survey question #9), else 0;
Size = natural log of total assets (in millions);
Leverage = total debt/total assets;
Exchange = dichotomous variable coded 1 for NYSE firms, else 0;
Inown = percentage of shares held by insiders and board of directors;
ACE = audit committee effectiveness variable coded 1 when the audit committee is comprised entirely of independent directors, includes a financial expert and meets at least four times annually, else 0;
Privacy = dichotomous variable coded 1 for an audit committee that meets privately with the internal auditor for all meetings (survey question #13), else 0; and

TABLE 8
OLS Regression Results
External Auditor Outsourcers Subsample

$$\begin{aligned} AUDRTMIX\%*OUTAUD\% = {} & b_0 + b_1\text{LN}(ASSETS) + b_2 RDSALES + b_3 TROUBLE \\ & + b_4 RECINV + b_5 RISKIND + b_6 ASSTGROW + b_7 ROA \\ & + b_8 FORSALES\% + b_9 GOVRNK + b_{10} ACE \\ & + b_{11} AUTHORITY + b_{12} ACE*AUTHORITY + \varepsilon \end{aligned}$$

Independent Variable	Expected Sign	Parameter Estimate	t-statistic
Intercept	?	0.539	0.259
LN(*ASSETS*)	+	−0.044	−1.147
RDSALES	−	−1.246	0.673
TROUBLE	+	−0.078	−0.727
RECINV	+	−1.044	0.967
RISKIND	+	0.028	0.154
ASSTGROW	+	0.002	1.998*
ROA	−	−0.352	−1.724*
FORSALES%	+	0.026	0.192
GOVRNK	−	−0.552	−0.211
ACE	−	−1.112	−5.355**
AUTHORITY	−	1.001	0.874
*ACE*AUTHORITY*	−	−0.639	−3.652**
Observations = 75			$R^2 = 0.089$

---

*, ** Differences are significant at two-sided (one-sided if in predicted direction) p-levels of less than 0.05 and 0.01, respectively.

OUTAUD% = the amount of externally provided internal audit hours (provided by either current external auditor or outside service provider) as a percentage of *total* internal audit hours per survey question #3; equal to (externally provided IA hours)/(externally provided IA + internally provided IA hours);

AUDRTMIX% = the proportion of outsourced internal audit activities to the external auditor that are routine in nature (defined as financial audits of subsidiaries, routine internal audit functions, and/or internal control evaluation);

ASSETS = total assets (in billions) (Compustat Item #6);

RDSALES = research and development expenditures as a percentage of total sales (Compustat Item #46/Item #12);

TROUBLE = dichotomous variable defined as 1 in cases where the company has experienced two net losses in any of the prior three fiscal years (Compustat Item #18);

RECINV = accounts receivable and inventory as a percentage of total assets ((Compustat Items #2 + #3)/Item #6);

RISKIND = 1 for risky industries (283x, 357x, 360x–367x, 737x, and 873x), else 0;

ASSTGROW = three-year realized growth rate of total assets (Compustat item #6) measured from 1998 to 2000, compounded annually;

ROA = return on assets (Compustat item #18/item #6);

FORSALES% = foreign sales as a percentage of total sales; (Compustat Segment File);

GOVRNK = decile ranking derived from factor analysis of the following five corporate governance factors: number of independent directors as a percentage of entire board, board size, inside ownership, CEO/chairman duality, and outside blockholder ownership percentage; firms are placed into deciles based upon their factor analysis score, with a ranking of 10 (1) for the highest (lowest) decile of *FAC*(*GOV*) scores;

ACE = AUDIT committee effectiveness variable coded 1 for an audit committee that is composed entirely of outside directors, contains at least one member with financial expertise, and meets at least four times annually, else 0; and

AUTHORITY = 1 in instances where survey states the audit committee has either joint or sole authorization to dismiss the chief internal auditor, else 0.

IADISC = dichotomous variable coded 1 for sample firms whose audit committee report or charter (per company proxy statement) discloses that the audit committee simultaneously reviews internal audit scope, plan, and results thereof, else 0; this variable is derived from Carcello et al. (2002).

In the regression model, *ACE*, *Privacy*, *Privacy*ACE*, and *IADISC* are all positive and significant at the 1 percent or 5 percent level. These univariate and multivariate results suggest that active and independent audit committees are more likely to be engaged in the oversight of the internal audit function—and to disclose this oversight relationship to shareholders. The statistically significant coefficient estimate on our privacy variable suggests that audit committee-internal audit communications are enhanced when meetings between the two are private. Moreover, the statistically significant *Privacy*ACE* coefficient suggests that the benefits of private audit committee-internal audit dialogue is enhanced in the presence of an independent, active audit committee. Thus, this additional evidence suggests a prominent role for the audit committee in the outsourcing decision.

We also conducted a number of additional sensitivity analyses, none of which affected our results in terms of sign or significance. First, we evaluated the approximately 10 percent of responses in which respondents indicated that their OSP provided "other" services. Activities under this definition included pension plan audits, statutory audits of foreign subsidiaries, etc. Based upon these answers, we categorized them into either specialized or routine in our reported regression results. As a sensitivity test we deleted these observations.

Second, we made the following separate changes to our regressions: using differential coding for those audit committees with joint versus sole authority over the employment of the internal auditor; utilizing the Gompers et al. (2003) G-score; and performing the analysis using OLS regression. We also performed the analysis with the three audit committee constructs entered separately. Independence and expertise were negatively, significantly related to our dependent variable, but our meetings variable was not.

Last, Abbott et al. (2003b) posit that audit committees face potential scrutiny regarding external auditor independence and related NAS audit fee disclosures. As such, we also included the ratio of NAS to audit fees ratio as an additional explanatory variable. The inclusion of this variable did not significantly alter our results.

VI. CONCLUSION

In this paper, we have examined one implication of SOX as it relates to restrictions on outsourcing internal audit tasks to the external auditor. The Act's provisions make no distinctions between routine and nonroutine activities, assuming that all outsourced IA activities have equally deleterious effects on auditor independence and audit quality. We argue that the outsourcing of nonroutine internal audit activities, (because of their nonrecurring and specialized nature) to the external auditor may have important benefits and limited negative effect on auditor independence. We hypothesize that effective audit committees (defined as those that are independent, meet frequently, and include a financial expert) are motivated to ensure overall audit quality and that such committees distinguish between the differential effects on independence of different types of outsourcing.

We tested our hypotheses using a sample of 219 survey responses from *Fortune* 1000 Chief Internal Auditors in the year 2000, the final year of the unregulated internal audit outsourcing environment. Our sample period is the last year in which there were few regulatory restrictions on the choice and nature of outsourcing activities and thus it allows us to explore relatively unfettered outsourcing arrangements. Our tests consist of regressions relating effective audit committees to the percentage of outsourcing of routine and nonroutine tasks to the external auditor and other outside service providers (OSPs). We obtain several interesting results. First, there appears to be a fundamental difference between activities outsourced to external auditors vis-à-vis outside service providers other than the external auditor. More specifically, companies outsourced a much greater (lower) percentage of specialized, nonrecurring IA activities to external auditors (OSPs). Second, effective audit committees were negatively associated with the outsourcing of routine internal audit activities to the external auditor. However, we did not find such an association between effective audit committees and the outsourcing of specialized, nonrecurring IA activities to the external auditor or the outsourcing of any IA activity to an OSP. Our results are consistent with effective audit committees being able to discern between both outsourcing vendor and outsourcing activity. We conclude that an effective audit committee may be an appropriate arbiter of the amount and nature of outsourcing and that consequently it may be appropriate to reconsider the current restrictions related to IA outsourcing. However, it is important to note that in the case of weak corporate governance, the current SOX restrictions may effectively prevent firms from making outsourcing decisions that are independence-impairing. Thus, the overall effect of the restrictions on IA outsourcing in practice may not be easy to ascertain, and forms an area for further research.

APPENDIX

Dear Sir or Madam:

We are conducting a brief survey to obtain data about the degree of outsourcing of the internal audit function present in your company and the primary factors in the outsourcing decision. Your insight is vital to this project, so please take a few minutes to complete the survey. *Please be assured that all responses will be strictly confidential, and no company or individual will be specifically identified. Thank you.*

1. Did you use any outsourced internal audit services during the past year?
   YES ____ NO ____
   If no, please go to question 9.
2. Which answer best describes your primary internal audit outside service provider (OSP)?
   CURRENT EXTERNAL AUDITOR OTHER CPA FIRM
   OTHER (please specify) ________________
3. During the last fiscal year, approximately how many hours were devoted to internal audit services by:
   OUTSIDE SERVICE PROVIDERS ________hours
   INTERNAL PROVIDERS ________hours
4. If you are currently outsourcing all or part of the internal audit function, how long has the current arrangement been in effect? _____years
5. If you do outsource internal audit, please indicate your level of agreement with the following reasons for doing so (please circle one for each item):

Expertise of outside service provider (OSP)	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Legal liability insurance of OSP	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Scheduling flexibility/time management	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Reducing overall cost of internal audit	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Improve internal audit quality	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree

6. Of the total internal audit hours currently being outsourced, please give the approximate percentage distribution of activities:

Financial statement audits of subsidiaries ______
Special consulting projects ______
Routine internal audit functions ______
EDP Auditing ______
Internal control evaluation ______
Other (please specify) ________

7. What are your plans regarding the level of internal audit outsourcing in fiscal 2001? (please check)

INCREASE % OF OUTSOURCING ___
DECREASE OUTSOURCING ___
MAINTAIN LEVEL___

8. If you answered "INCREASE" to question 7, please answer this question. If you answered "DECREASE" or "MAINTAIN" to question 7, please skip this question and go to question 9.

Please indicate your level of agreement with the following reasons for increasing the level of outsourcing (please circle one for each item).

Expertise of outside service provider (OSP)	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Legal liability insurance of OSP	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Scheduling flexibility/time management	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Reducing overall cost of internal audit	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree
Improve internal audit quality	Strongly Agree	Agree	Neutral	Disagree Strongly	Disagree

9. Does the audit committee review:

Internal audit proposals related to:			Results of internal auditing related to:		
• Programs/plans	YES	NO	• Financial reporting	YES	NO
• Budget	YES	NO	• Internal control	YES	NO
• Coordination with external auditors	YES	NO	• Compliance with laws/regulations	YES	NO

10. Does the audit committee review/inquire with the chief internal auditor regarding:

- management response to internal auditing findings/suggestions
  YES NO
- any difficulties/scope restrictions encountered by internal auditing
  YES NO

11. Who in your company has the authority to dismiss the chief internal auditor?
Title: ____________________

If the audit committee does not have sole dismissal authority, does the committee still have to be informed for approval prior to the dismissal? (please circle)
YES NO

12. Each year, the audit committee meets ___ times with the chief internal auditor.

13. Does the chief internal auditor meet *privately* (without management present) with the audit committee?

ALL MEETINGS ARE ENTIRELY PRIVATE ___
ALL MEETINGS HAVE SOME PRIVATE TIME ___
NOT ALL, BUT ___ MEETINGS A YEAR HAVE PRIVATE TIME
NO PRIVATE MEETINGS ___

14. Is internal auditing viewed as a training ground in your company?
YES___ NO ___

15. If you do *not* outsource internal audit, please indicate your level of agreement with the following reasons for not doing so (please circle one for each item):

Confidentiality of information	Strongly Agree Agree Neutral Disagree Strongly Disagree
Alignment with organizational culture	Strongly Agree Agree Neutral Disagree Strongly Disagree
Scheduling flexibility/time management	Strongly Agree Agree Neutral Disagree Strongly Disagree
Reduction of total internal audit cost	Strongly Agree Agree Neutral Disagree Strongly Disagree
Reduction of external audit quality	Strongly Agree Agree Neutral Disagree Strongly Disagree
Reduction of total audit costs	Strongly Agree Agree Neutral Disagree Strongly Disagree

16. Does internal auditing do the following with respect to interaction with external auditors:

Coordinate work with respect to:			Do the external auditors have free access to *all*:		
• areas of audit coverage	YES	NO	• workpapers	YES	NO
• work schedule	YES	NO	• reports	YES	NO

17. We are very interested in your views on the reasons your firm chose one type of internal audit sourcing (in-house versus externally provided) over another, and the level chosen. Please include any comments you may have on a separate sheet.

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Cost Allocation for Capital Budgeting Decisions

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ABSTRACT: Investment decisions frequently require coordination across multiple divisions of a firm. This paper explores a class of capital budgeting mechanisms in which the divisions issue reports regarding the anticipated profitability of proposed projects. To hold the divisions accountable for their reports, the central office ties the project acceptance decision to a system of cost allocations comprised of depreciation and capital charges. If the proposed project concerns a common asset that benefits multiple divisions, then our analysis derives a sharing rule for dividing the asset among the users. Capital charges are based on a hurdle rate determined by the divisional reports. We find that this hurdle rate deviates from the firm's cost of capital in a manner that depends crucially on whether the coordination problem is one of implementing a common asset or choosing among multiple competing projects. We also find that more severe divisional agency problems will increase the hurdle rate for common assets, yet this is generally not true for competing projects.

I. INTRODUCTION

Capital budgeting decisions frequently affect multiple entities, such as departments or divisions, within a firm. Decision externalities may arise because divisional investment opportunities are mutually exclusive due to limited investment budgets or due to a required intermediate good that can be procured from more than one division. Alternatively, firms may be in a position to acquire common assets that are of use to

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multiple divisions at the same time. The capital budgeting process must then determine whether the aggregated individual benefits justify the common investment expenditure.[1]

The management literature provides only scant evidence regarding firms' actual capital budgeting practices; see for example Kaplan and Atkinson (1998) and Taggart (1987). Some authors have suggested that firms could operate market mechanisms, such as auctions, in order to solve their capital budgeting problems, e.g., Hodak (1997). One approach that seems prevalent in practice is that firms set *hurdle rates* that must be met by individual projects in order to receive funding. However, there does not seem to be a well-accepted methodology either for setting hurdle rates or for including them in the system of divisional performance measurement.

This paper explores a class of capital budgeting mechanisms for which the firm's central office commits to a decision rule in response to divisional reports about the projected profitability of particular projects. To hold the divisions accountable for their reports, the central office specifies cost charges to be imposed in subsequent periods. These cost charges comprise both depreciation and capital charges, with the latter based on a hurdle rate that is determined by the initial divisional reports. We focus on charging mechanisms that satisfy the usual accounting convention that the sum of all depreciation charges across time periods and across divisions be equal to the initial investment expenditure.

The survey evidence of Poterba and Summers (1995) and others has shown that internal hurdle rates frequently exceed a firm's actual cost of capital by a substantial margin. Consistent with this evidence, the capital budgeting literature has shown that with private managerial information second-best mechanisms entail capital rationing.[2] This tendency emerges because the principal is better off forgoing marginally profitable projects in order to economize on the manager's informational rents (the premium a manager must be paid for truthful reporting). One way to implement such capital rationing is to raise the hurdle rate above the firm's cost of capital. Consequently, these models predict that higher agency costs will result in more severe capital rationing and, thus, higher hurdle rates. In our multidivisional setting, hurdle rates can be interpreted as a "shadow price" of capital that reflects two distinct though related factors: (1) the interdivisional coordination problem due to decision externalities, and (2) agency costs at the divisional level. In contrast to single division settings, we find that the hurdle rate will differ from the firm's cost of capital even in the absence of any agency costs. Whether the hurdle rate will be set above or below the firm's cost of capital depends on the nature of the decision externality, i.e., whether the asset is shared or used exclusively by only one division, and the relative magnitude of the divisional agency costs.

Suppose first that the capital budgeting problem is such that each division has an investment opportunity, but at most one of the *n* divisional projects can be funded. In such settings, we identify a *Competitive Hurdle Rate* (CHR) mechanism that is, effectively, a multiperiod version of the second-price auction. In particular, the winning division faces a hurdle rate that is unaffected by its own report. In the special case where the divisional projects are *ex ante* identical, the competitive hurdle rate is simply the second highest reported internal rate of return. The CHR mechanism also specifies a depreciation schedule for the initial investment. If this schedule conforms to the so-called relative benefit rule, then the project's *NPV* is reflected in a time-consistent manner in the divisional performance measure.[3] These features make the CHR mechanism strongly incentive-compatible in the sense that divisional managers have a dominant-strategy incentive to report their information truthfully regardless of the weights (determined by intertemporal preferences and compensation payments) that they attach to outcomes in different time periods.

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[1] A recent illustration of such "public goods" problems was provided to us by a California semiconductor manufacturer where several product lines (profit centers) were using a common fabrication facility. The product line managers regularly encouraged the firm's central office to upgrade the equipment in the manufacturing facility. However, the firm's central office was reluctant to undertake these upgrades as it worried about "creative optimism" by the divisions, partly because the firm did not have a methodology for allocating investment expenditures among the users of the facility.

[2] See, for instance, Antle and Eppen (1985).

We establish that the CHR mechanism is the only *satisfactory* capital budgeting mechanism that achieves both strong incentive compatibility and efficient project selection. This uniqueness finding relies in part on a well-known result by Green and Laffont (1979) in the earlier public choice literature: the discounted total charges to the divisions must conform to a Groves scheme (Groves 1973) in order to obtain dominant strategies. Since we postulate that a division will not be charged unless its project is funded, the class of feasible Groves mechanisms reduces to the so-called *Pivot* mechanism: a division is charged if and only if its report is pivotal in the sense that it changes the resource allocation decision. Finally, it has been shown that the Pivot mechanism amounts to a second-price auction in settings where an indivisible good is allocated among n participants.[4]

Our results are consistent with Poterba and Summers (1995) insofar as the competitive hurdle rate exceeds the firm's cost of capital. Nonetheless, the CHR mechanism is balanced in the sense that the discounted sum of depreciation and capital charges is equal to the initial investment expenditure provided the future cost charges are discounted at the competitive hurdle rate. This is a direct consequence of the postulate of comprehensive income measurement requiring the sum of the depreciation charges to equal the initial investment expenditure incurred by the winning division.[5]

We identify a class of environments for which the CHR mechanism is optimal among all revelation mechanisms. In contrast to single-agent settings, however, our analysis shows that the hurdle rate will be unaffected if the agency cost for *each* division goes up by the same factor and the divisions face comparable projects, *ex ante*.[6] At the same time, it will be beneficial to use the hurdle rate as an instrument for "handicapping" divisions that (i) are *ex ante* likely to have access to more profitable projects and (ii) face relatively high agency costs. We demonstrate that optimal capital budgeting mechanisms have the feature that, *ceteris paribus*, those divisions face higher hurdle rates.

When the capital budgeting problem concerns the acquisition of a common or shared asset to which all divisions have access, our findings are, in several respects, "dual" to the ones obtained in connection with exclusive assets. Invoking again the criterion of satisfactory mechanisms, we identify the so-called *Pay-the-Minimum-Necessary* (PMN) mechanism as the unique mechanism that results in efficient project selection decisions in a (strongly) incentive compatible manner. In present value terms, the PMN mechanism charges every division its "critical value," the present value that this division would have to obtain from the joint asset in order for the investment to just break even. To implement this rule in a time consistent fashion, each division is assigned a *share* of the joint investment expenditure as a divisional asset. The shares are set in proportion to the critical values and the capital charge rate under the PMN mechanism is given by the project's internal rate of return evaluated at the critical values.

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[3] This feature has been established in the earlier work on goal-congruent performance measures for investment decisions involving a single division, e.g., Rogerson (1997) and Reichelstein (1997).

[4] See Mas-Colell et al. (1995) and Krishna (2002).

[5] In one-period settings, Pivot mechanisms are well-known to attain a budget surplus. Since the CHR mechanism is a multiperiod version of the Pivot mechanism surplus, one would expect the CHR mechanism to overcharge the winning division. This is true in the sense that the discounted sum of depreciation and capital charges exceeds the initial investment if the discount rate is given by the firm's cost of capital, which is below the competitive hurdle rate.

[6] This finding is based on the same argument showing that under certain conditions the second price auction is a revenue-maximizing mechanism; see, for example, Myerson (1981). In particular, this result obtains if the bidder with the highest intrinsic value for the object also has the highest virtual value.

In contrast to our findings for exclusive assets, the capital charge rate under the PMN mechanism is below the firm's cost of capital. As a consequence, the PMN mechanism effectively runs a deficit in present value terms.[7] While the sum of all depreciation charges across time periods and divisions is equal to the acquisition cost of the joint asset, the discounted sum of all depreciation and capital charges is less than the initial acquisition cost, provided these charges are discounted at the firm's cost of capital. Intuitively, the need for such subsidization arises because of the public goods nature of the common asset. The divisions no longer compete but instead exert a positive externality upon one another.

In order for the PMN mechanism to be a second-best contracting mechanism for shared assets, the capital charge rate must increase monotonically in the agency costs of each division. This reflects that the total net profitability of the shared asset decreases with the sum of the individual agency costs (for exclusive assets, in contrast, it is the relative magnitude of the individual agency costs that matters). We conclude that for shared assets the PMN mechanism may result in an agency-adjusted capital charge rate that can be either above or below the firm's cost of capital. The criterion for efficient project selection tends to push the capital charge rate below the firm's cost of capital, while agency costs tend to push in the opposite direction.

In terms of prior literature, our work builds on a range of studies that have examined the role of cost allocation mechanisms in guiding intrafirm resource allocation; papers in this category include Zimmerman (1979), Baiman and Noel (1985), Rajan (1992), and Pfaff (1994), among others. These studies have focused on cross-sectional cost allocations in a one-period setting. Similarly, most of the existing work on multi-agent budgeting mechanisms has been confined to single-period studies, e.g., Harris et al. (1982), Kanodia (1993), Balakrishnan (1995), Arya et al. (1996), Harris and Raviv (1996), Chen (2003), and Bernardo et al. (2004).[8]

Intertemporal cost allocations have been central to the prior work on accrual accounting for performance measurement, such as Rogerson (1997) and Reichelstein (1997), Wei (2004), and Bareket and Mohnen (2007). One conclusion in these models is that in the absence of moral hazard, the capital charge rate should be set equal to the firm's cost of capital in order to obtain goal-congruent performance measures. In contrast, Dutta and Reichelstein (2002) and Christensen et al. (2002) question the usual textbook recommendation of setting the capital charge rate equal to the firm's weighted average cost of capital if risky projects are to be selected by a risk- and effort-averse manager.[9] All of these studies focus on a single representative agent without addressing coordination issues across multiple divisions.[10]

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[7] Consistent with this observation, the PMN mechanism is not a multiperiod version of the Pivot mechanism.

[8] Our finding regarding capital charge rates that differ from the firm's actual cost of capital is reminiscent of earlier work on "strategic" internal pricing, such as Hughes and Kao (1997), Alles and Datar (1998), and Arya and Mittendorf (2005). The main theme in these models is that a firm's central office sets internal prices (e.g., cost allocations) so as to affect the competitive outcome between the firm's divisions and external rivals. Goex and Schiller (2006) provide a survey of this literature.

[9] Baldenius (2003) links the choice of the capital charge rate to empire benefits that managers derive from new investments. Baldenius and Ziv (2003) consider the effect of income taxes on capital charge rates. Dutta (2003) examines a firm's choice of capital charge rate when its manager has the option of pursuing the investment project as an outside venture on his own.

The remainder of the paper is organized as follows. Section II examines satisfactory capital budgeting mechanisms for both exclusive and shared assets. Agency costs and second-best contracting mechanisms are the subject of Section III. We conclude in Section IV.

II. SATISFACTORY CAPITAL BUDGETING MECHANISMS

We examine mechanisms for coordinating investment decisions in a firm comprised of n divisions and a central office. At the initial date, the firm can acquire a capital asset with a useful life of T years. The firm's central office faces an incentive and coordination problem because the division managers have private information regarding the subsequent operating profitability of the asset. To study the most common forms of interdivisional coordination problems, we consider two scenarios: (1) *shared* and (2) *exclusive* assets.

In the case of shared assets, the firm has access to a common investment project that, if undertaken, generates future revenues for *all n* divisions. In that sense, the common investment project is a "public good" that benefits all divisions. For the scenario of exclusive assets, in contrast, each division is assumed to have one investment opportunity, yet for exogenous reasons the firm can undertake at most one of these n divisional projects. Each project, if undertaken, generates subsequent cash flows only for that particular division. In this setting, the projects are "private goods" and the divisions compete for scarce investment capital.

Without loss of generality, each division's *status quo* operating cash flow (in the absence of any new investment) is normalized to zero. When division i has access to the new investment (exclusive or shared), its periodic operating cash flows take the form:

$$c_{it} = x_{it} \cdot \theta_i. \tag{1}$$

Here, $\theta_i \in \Theta_i = [\underline{\theta}_i, \bar{\theta}_i]$ denotes the profitability parameter of division i, with $\underline{\theta}_i \geq 0$. The vector of profitability parameters of all n divisions will be denoted by $\theta = (\theta_1,...,\theta_n)$ and $\theta_{-i} \equiv (\theta_1,...,\theta_{i-1}, \theta_{i+1},...,\theta_n)$ denotes the profitability profile of all divisions other than i. While θ_i is assumed to be known only to manager i, the intertemporal distribution of future cash flows, as represented by the vector $X_i = (x_{1i},...,x_{iT}) \in R^T_+$, is commonly known.[11]

The firm's cost of capital is given by $r \geq 0$ with $\gamma = 1/(1 + r)$ representing the discount factor. The present value of division i's cash flows is:

$$\begin{aligned} PV_i(\theta_i) &= \sum_{t=1}^{T} \gamma^t \cdot x_{it} \cdot \theta_i \\ &\equiv \Gamma \cdot X_i \cdot \theta_i, \end{aligned}$$

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[10] An exception is Wei (2004) who studies a setting with symmetric information across managers and shows that fixed cost allocations can alleviate divisional underinvestment problems.

[11] The effective useful life of a project can be $\tau < T$ periods, in which case $x_{it} = 0$ for all $\tau \leq t \leq T$. The central assumption underlying (1) is that the designer knows not only the useful life of the asset, but also the intertemporal pattern of cash flows. For instance, if the investment pertains to a new production facility, the parameters x_{it} may reflect the known production capacity available in different periods, while θ_i represents the (expected) contribution margin, which is known only to the divisional manager. Similar assumptions are made in Rogerson (1997), Reichelstein (1997), Baldenius and Ziv (2003), Wei (2004), and Bareket and Mohnen (2007).

where $\Gamma \equiv (\gamma,...,\gamma^T)$. Initially, we ignore moral hazard problems and their associated agency costs and instead focus on the choice of *goal-congruent* performance measures for divisional managers. As shown in Section III below, the mechanisms identified in this section can be adapted to optimal second-best mechanisms so as to include issues of moral hazard and managerial compensation. Following the terminology in earlier literature, a performance measure is said to be *goal congruent* if it induces managers to make decisions that maximize the present value of firm-wide cash flows. In our search for goal-congruent performance measures, we confine attention to accounting-based metrics of the form:

$$\pi_{it} = Inc_{it} - \hat{r} \cdot A_{i,t-1}, \tag{2}$$

where A_{it} denotes book value of division i's asset at the end of period t, and $\hat{r}$ is a capital charge rate applied to the beginning book value. The net asset value at the end of period t is given by:

$$A_{it} = A_{i,t-1} - d_{it} \cdot A_{i0},$$

where d_{it} denotes the period t depreciation percentage for division i in period t and A_{i0} represents the initial asset value assigned to division i. Given comprehensive income measurement, income in period t is calculated as:

$$\begin{aligned} Inc_{it} &= c_{it} + A_{it} - A_{i,t-1} \\ &= c_{it} - d_{it} \cdot A_{i0}. \end{aligned}$$

We note that the class of performance measures in Equation (2) encompasses the most common accounting performance metrics such as income, residual income, and operating cash flow. To create reporting incentives, the central office has two principal instruments: the capital charge rate $\hat{r}$ and the depreciation rules $\{d_{it}\}_{t=1}^{T}$. In our search for alternative capital budgeting mechanisms, we focus on balanced cost allocations satisfying the property that the sum of all depreciation charges across agents and across time periods is equal to the amount initially invested.

Performance measures are required to have a "robustness" property such that the desired incentives hold even if a divisional manager attaches weights to future outcomes that differ from those of the firm that is interested in the present value of future cash flows. Let $u_i = (u_{i1},...,u_{iT})$ denote non-negative weights that manager i attaches to the sequence of performance measures $\pi_i = (\pi_{1i},...,\pi_{iT})$. At the beginning of period 1, manager i's objective function can thus be written as $\Sigma_{t=1}^{T} u_{it} \cdot E[\pi_{it}]$. One can think of the weights u_i as reflecting a manager's discount factor as well as the bonus coefficients attached to the periodic performance measures. We require goal congruence for all u_i in some open set in $V_i \subset R_+^T$. For instance, V_i could be a neighborhood around $(u \cdot \gamma, u \cdot \gamma^2,...,u \cdot \gamma^T)$ for some constant bonus coefficient u.[12] Let $\pi_{it}(\tilde{\theta}_i, \tilde{\theta}_{-i}|\theta_i)$ denote manager i's period t performance measure when his true type is θ_i, but he reports $\tilde{\theta}_i$ and the other $n-1$ managers report $\tilde{\theta}_{-i}$. A performance measure satisfies *strong incentive compatibility* if:

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[12] In order to assess the robustness of a particular mechanism one would like v_i to be as large as possible, e.g., the entire R_+^T. On the other hand, any necessity result pointing to the uniqueness of a particular mechanism becomes more powerful if derived with reference to a smaller set V_i. For now, it is useful to view u_{it} as a summary statistic for the manager's discount factor and the bonus coefficients in his compensation function. In Section III, the coefficients u_{it} will emerge endogenously from the underlying agency problem.

$$\sum_{t=1}^{T} u_{it} \cdot \pi_{it}(\theta_i, \theta_{-i}|\theta_i) \geq \sum_{t=1}^{T} u_{it} \cdot \pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i), \quad \text{for all } i,\ \theta_i,\ \tilde{\theta}_i,\ \theta_{-i},\ u_i \in V_i. \tag{3}$$

Our requirement of strong incentive compatibility amounts to dominant-strategy incentives for truthful reporting in a setting where the designer is also uncertain about the weights that managers attach to their performance measures in different periods. This form of strong incentive compatibility will prove useful below when moral hazard is added to the model and the intertemporal weights u_{it} are determined by the managerial compensation schemes.

Shared Assets

We first study the design of capital budgeting mechanisms for a setting in which the asset acquired is shared among the n divisions in the sense that all divisions can have simultaneous access to the asset and derive future cash benefits from it. Applicable examples include cost reducing investments in a manufacturing process that is used by all divisions, certain forms of IT services or "lumpy" investments in capacity that alleviate any subsequent capacity constraints. The "common good" requires an initial cash outlay of b and generates (incremental) operating cash flows in the amount of $x_{it} \cdot \theta_i$ for divisions $1 \leq i \leq n$ in periods $1 \leq t \leq T$. For each division, the profitability parameter θ_i is private information. The *corporate* net present value (*NPV*) of the project then equals:

$$NPV(\theta) = \sum_{i=1}^{n} PV_i(\theta_i) - b.$$

The corresponding *internal rate of return*, denoted by $r^o(\theta)$, is implicitly defined by:

$$\sum_{i=1}^{n} \sum_{t=1}^{T} (1 + r^o(\theta))^{-t} \cdot x_{it} \cdot \theta_i = b.$$

We note that the internal rate of return $r^o(\theta)$ is unique because $\theta_i > 0$ and $x_{it} \geq 0$. The indicator variable $I \in \{0, 1\}$ will be used to represent whether the common project is undertaken. The first-best investment rule $I^*(\theta)$ calls for the investment to be made whenever $NPV(\theta) \geq 0$ or, equivalently, whenever $r^o(\theta) \geq r$.

To obtain goal congruence, a capital budgeting mechanism for shared assets relies on four instruments: an investment rule, an asset allocation rule, a capital charge rate, and depreciation schedules. To compute the divisional performance measure in Equation (2), the asset allocation rule assigns each division a share, $\lambda_i \cdot b$, of the joint asset's initial investment cost b. This amount is capitalized on the divisional balance sheet and subsequently depreciated over the next T periods according to the specified depreciation schedule $d_i = (d_{i1},...,d_{it})$. The book value of division i's asset at date t is therefore given by:

$$A_{it} = A_{i,t-1} - d_{it} \cdot \lambda_i \cdot b = \left(1 - \sum_{\tau=1}^{t} d_{i\tau}\right) \cdot \lambda_i \cdot b. \tag{4}$$

Formally, a capital budgeting mechanism for shared assets specifies the following items:

- Investment rule $I: \Theta \rightarrow \{0, 1\}$;
- Asset allocation rule $\lambda_i: \Theta \rightarrow [0, 1]$ satisfying the requirement $\Sigma_{i=1}^{n} \lambda_i(\theta) = 1$;

- Capital charge rate $\hat{r}:\Theta \rightarrow (-1, \infty)$; and
- Depreciation schedules $d_i:\Theta \rightarrow R_+^T$ satisfying the conditions that $\Sigma_{t=1}^T d_{it}(\theta) = 1$ if $I(\theta) = 1$, and $d_{it}(\theta) \equiv 0$ if $I(\theta) = 0$.

We note that mechanisms are restricted to satisfy a "no-play-no-pay" condition: the divisions can be charged only if the joint asset is acquired, i.e., $I(\theta) = 1$. A capital budgeting mechanism is called *satisfactory* if (i) it is strongly incentive compatible as defined in Equation (3), and (ii) the project is undertaken, if and only if $NPV(\theta) \geq 0$.

Given the asset valuation rule in Equation (4), the divisional performance measure in Equation (2) becomes:

$$\pi_{it} = (x_{it} \cdot \theta_i - z_{it} \cdot \lambda_i \cdot b) \cdot I, \tag{5}$$

where:

$$z_{it} = d_{it} + \hat{r} \cdot \left(1 - \sum_{\tau=1}^{t-1} d_{i\tau}\right) \tag{6}$$

denotes the sum of depreciation and interest charge in period t. Following Rogerson (1997), we refer to $\{z_{it}\}_{t=1}^T$ as an *intertemporal cost allocation.* Earlier studies on goal congruence have observed that for any given capital charge rate, $\hat{r}$, there is a one-to-one mapping between depreciation and intertemporal cost allocation schemes. In particular, there exists a unique intertemporal cost allocation such that:

$$z_{it} = \frac{x_{it}}{\Sigma_{\tau=1}^T (1 + \hat{r})^{-\tau} \cdot x_{i\tau}}. \tag{7}$$

The significance of this *relative benefit cost allocation* is that, for a given asset allocation rule $\{\lambda_i\}_{i=1}^n$, division i's residual income measure, relative to the capital charge rate $\hat{r}$, will in each period be proportional to the divisional *NPV*, $PV_i(\theta_i|\hat{r}) - \lambda_i \cdot b$, which is obtained by discounting future cash flows at the rate $\hat{r}$. Thus, for a capital budgeting problem with a single agent, the principal can achieve goal congruence by setting $\hat{r} = r$. The unique depreciation schedule that gives rise to the cost allocation charges in Equation (7) is referred to as the *relative benefit depreciation* rule.[13]

Let $\theta_i^*(\theta_{-i})$ denote the *critical* profitability parameter of division i, that is, the value of θ_i at which the project breaks even, given the valuations θ_{-i} of all other divisions. Thus, $\theta_i^*(\theta_{-i})$ is defined implicitly by:

$$PV_i(\theta_i^*(\theta_{-i})) + \sum_{j \neq i} PV_j(\theta_j) = b. \tag{8}$$

Assumption 1: Each division is essential in the sense that $\theta_i^*(\theta_{-i}) \geq \underline{\theta}_i$ for all i and θ_{-i}.

Assumption 1 stipulates that $\Sigma_{j \neq i} PV_j(\theta_j) + PV_i(\underline{\theta}_i) < b$ for all i and θ_i. The corresponding restriction on the range of divisional profitability parameters Θ_i is easier to satisfy in a setting with just a "small" number of participating divisions. As demonstrated at the end of this subsection, our main results can be extended to environments beyond those conforming to Assumption 1.

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[13] It is well known that this rule amounts to the annuity depreciation method in case the x_{it}'s are constant across time periods. On the other hand, if cash flows were to decline geometrically at a rate of α over an infinite horizon, then relative benefit depreciation would amount to a declining balance method with decline factor $(1 - \alpha)$.

The following capital budgeting mechanism will be referred to as the *Pay-the-Minimum-Necessary* (PMN) mechanism:

(i) $I(\theta) = I^*(\theta)$;

(ii) $\hat{r} = r^*(\theta) \equiv r^o(\theta_1^*(\theta_{-1}),\ldots,\theta_n^*(\theta_{-n}))$;

(iii) $\lambda_i(\theta) = \dfrac{\Gamma^*(\theta) \cdot X_i \cdot \theta_i^*(\theta_{-i})}{\Sigma_{j=1}^n \Gamma^*(\theta) \cdot X_j \cdot \theta_j^*(\theta_{-j})}$; and

(iv) Depreciation is calculated according to the relative benefit rule based on the capital charge rate $r^*(\theta)$;

where $\Gamma^*(\theta) \equiv ((1 + r^*(\theta))^{-1},\ldots,(1 + r^*(\theta))^{-T})$. The PMN mechanism sets the capital charge rate equal to the project's internal rate of return at the critical profitability levels $\theta_i^*(\theta_{-i})$. The asset-sharing rule in (iii) allocates the initial investment cost in proportion to the divisional present values generated by the common asset, evaluated at the critical profitability parameters. If the aggregate present value of all divisions other than i approaches b (note that it cannot exceed b by Assumption 1), then division i's assigned ownership share $\lambda_i(\theta)$ will tend to be small, whereas it will tend be large when the aggregate valuation of the other divisions is small. These characterizations follow directly upon observing that, by the definition of the internal rate of return, $\Sigma_{j=1}^n \Gamma^*(\theta) \cdot X_j \cdot \theta_j^*(\theta_{-j}) = b$.

The relative benefit depreciation rule in (iv) ensures that the cost charge to division i in period t is given by:

$$z_{it}(\theta) \cdot \lambda_i \cdot b = \frac{x_{it}}{\Gamma^*(\theta) \cdot X_i} \cdot \lambda_i \cdot b.$$

Using again the fact that $\Sigma_{j=1}^n \Gamma^*(\theta) \cdot X_j \cdot \theta_j^*(\theta_{-j}) = b$, it follows that the charge to division i in period t is given by:

$$z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b = x_{it} \cdot \theta_i^*(\theta_{-i}). \tag{9}$$

Thus, the performance measure under the PMN mechanism reduces to:

$$\pi_{it}(\theta) = x_{it} \cdot [\theta_i - \theta_i^*(\theta_{-i})], \tag{10}$$

making it a dominant strategy for each manager to report truthfully. Equation (10) shows that this incentive holds not only in the aggregate, i.e., over the entire planning horizon, but on a period-by-period basis. We have demonstrated that the PMN mechanism is satisfactory. The following result shows that within the class of capital budgeting mechanisms we consider there is in fact no other satisfactory mechanism.[14]

Proposition 1: Given Assumption 1, the Pay-the-Minimum-Necessary (PMN) mechanism is the unique satisfactory capital budgeting mechanism for shared assets.

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[14] All proofs are in Appendix A.

To provide intuition for the uniqueness of the PMN mechanism, it is useful first to consider settings in which each manager attaches the same weights to future payoffs as the firm's owners; that is, it is commonly known that $u_{it} = \gamma^t \cdot u$ for each i and t. In such a setting, intertemporal matching is of no importance and it suffices to ensure dominant strategy incentive compatibility over the entire planning horizon, rather than on a period-by-period basis. As demonstrated in the public choice literature (e.g., Green and Laffont 1979), every dominant-strategy mechanism must be a Groves scheme if the organization is to achieve efficient outcomes. Under a Groves scheme, each participant's payoff is the same as the social surplus up to a constant that does not depend on the report by that participant. Since manager i already internalizes his own surplus, $PV_i(\theta_i)$, the transfer payment must be equal to the maximized surplus of the remaining $n - 1$ divisions plus some amount that is a constant from i's perspective. Given the performance measure in Equation (5), the present value of the cost charges to division i must satisfy:

$$\sum_{t=1}^{T} z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b \cdot \gamma^t = -\left(\sum_{j \neq i} PV_j(\theta_j) - b\right) \cdot I^*(\theta_i, \theta_{-i}) + h_i(\theta_{-i}),$$

where $h_i(\cdot)$ is an arbitrary function of θ_{-i}. In conjunction with Assumption 1, the no-play-no-pay condition requires that this "remainder" term $h_i(\cdot)$ must be equal to zero.

By construction of the critical types, we find that:

$$\sum_{t=1}^{T} z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b \cdot \gamma^t = PV_i(\theta_i^*(\theta_{-i})) \cdot I^*(\theta_i, \theta_{-i}). \tag{11}$$

When expressed in this form, the label "Pay-the-Minimum-Necessary" becomes transparent; given the valuations reported by the other divisions, the present value charge to each division is the minimum amount required in order for the project to break even.

Our notion of strong incentive compatibility requires truthful reporting to be a dominant strategy for each manager for an entire neighborhood of u_i. As a consequence, the aggregate cost charge in Equation (11) must be annuitized so that:

$$z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b = x_{it} \cdot \theta_i^*(\theta_{-i}) \cdot I^*(\theta_i, \theta_{-i}). \tag{12}$$

The remaining question is whether there exist other combinations of asset allocation rules, capital charge rates, and depreciation schedules that can yield the same periodic cost charges as those in Equation (12). The answer to this question is provided by the following observation that we state as separate lemma because it will be used again later.[15]

Lemma 1: Let $D = \{(d_1,\ldots,d_T) | \Sigma_{t=1}^{T} d_t = 1\}$ denote the set of all depreciation schedules. The mapping $f_t : D \times (-1, \infty) \rightarrow R^T$, given by:

$$f_t(d, \hat{r}) = d_t + \hat{r} \cdot \left(1 - \sum_{\tau=1}^{t-1} d_\tau\right) \tag{13}$$

is one-to-one. Its image contains R_+^T and $\Sigma_{t=1}^{T} (1 + \hat{r})^{-t} \cdot f_t(d, \hat{r}) = 1$ for all $(d, \hat{r})$.

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[15] This result generalizes Corollary 3 in Rogerson (1997).

For a given assets-sharing rule, Lemma 1 implies that the intertemporal cost allocation charge in Equation (12) can only be generated by the relative benefit depreciation rule and the capital charge rate $r^*(\theta)$. Given this observation, it follows directly that the asset shares $\lambda_i(\theta)$ must be the ones specified under the PMN mechanism.

The public choice literature has shown that it is generally impossible to attain efficient outcomes in dominant strategies while keeping the budget balanced. In contrast, Proposition 1 demonstrates the possibility of an efficient capital budgeting mechanism by means of conventional cost allocations that are *nominally* balanced. However, in present value terms investment in the shared assets must be "subsidized" by the central office by way of a reduced capital charge rate. To see this, we note that:

$$\begin{aligned} r &\equiv r^o(\theta_{-i}, \theta_i^*(\theta_{-i})) \\ &\geq r^o(\theta_1^*(\theta_{-1}), \ldots, \theta_n^*(\theta_{-n})) \\ &= r^*(\theta), \end{aligned}$$

where the inequality holds because the internal rate of return $r^o(\theta_1, \ldots, \theta_n)$ is monotone increasing in each of its arguments and $\theta_i \geq \theta_i^*(\theta_{-i})$ for any positive-*NPV* project.[16]

Corollary 1: Under the PMN mechanism, the capital charge rate, $r^*(\theta)$, is less than the firm's cost of capital, r.

An alternative way to attain the same outcomes would be for the central office to hold the capital charge rate at r while lowering the initial capital allocation for each division to:

$$\hat{\lambda}_i(\theta_{-i}) \equiv \frac{b - \Sigma_{j \neq i} PV_j(\theta_j|r)}{b}.$$

However, because $\Sigma_{i=1}^n \hat{\lambda}_i(\theta_{-i}) = \frac{1}{b}[n \cdot b - (n-1) \cdot \Sigma_{i=1}^n PV_i(\theta_i)] < 1$ whenever $I(\theta) = 1$, this approach violates the basic accrual accounting requirement that the sum of all depreciation charges across time periods and participating divisions be equal to the initial investment outlay.

It is instructive to examine how division i's assigned share of the joint investment, $\lambda_i(\theta)$, depends on that division's report. In the special case of identical X_j, the PMN mechanism divides the initial investment cost simply in proportion to the critical profitability levels. That is:

$$\lambda_i(\theta) = \frac{\theta_i^*(\theta_{-i})}{\Sigma_{j=1}^n \theta_j^*(\theta_{-j})}.$$

Since the critical profitability level $\theta_j^*(\theta_{-j})$ is decreasing in θ_i for all $i \neq j$, the share of initial investment cost allocated to division i is *increasing* in its own profitability parameter

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[16] Because of the public goods nature of the shared asset, the capital charge rate is (weakly) decreasing in the number of participants. Specifically, suppose $\theta^o \equiv (\theta_1^o, \ldots, \theta_n^o)$ is the profitability profile of the existing n divisions and let $r^*(\theta^o)$ be the capital charge rate for the corresponding PMN mechanism. It is readily verified that if an additional division with profitability parameter θ_{n+1} participates in the asset acquisition decision, then $r^*(\theta^o, \theta_{n+1}) < r^*(\theta^o)$, regardless of the type θ_{n+1} of the new participant.

θ_i. This comparative statics continues to hold more generally when the X_j differ across divisions.

Corollary 2: Under the PMN mechanism, the share of investment cost allocated to division i, $\lambda_i(\theta)$, is increasing in the profitability parameter θ_i.

A necessary feature of any dominant-strategy mechanisms for a binary decision is that, contingent on the project being undertaken, the cost charge to any participant must be independent of its own report. Corollary (2) and the capital charge rate $r^*(\theta) = r^o(\theta_1^*(\theta_{-1}),...,\theta_n^*(\theta_{-n}))$ may suggest that the PMN mechanism violates this property. However, while both $r^*(\theta)$ and $\lambda_i(\theta)$ vary with manager i's report θ_i, the fact that $z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b = x_{it} \cdot \theta_i^*(\theta_{-i}) \cdot I^*(\theta_i, \theta_{-i})$ shows that these partial effects exactly offset each other, i.e., the resulting sum of depreciation and capital charges, $z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b$, is indeed independent of θ_i.

It is instructive to note that the PMN mechanism is not a multiperiod version of the so-called *Pivot* mechanism. In the public choice literature, it is usually assumed that the cost of the public investment is divided in some arbitrary, say equal, fashion among all participants (e.g., Kreps 1990; Mas-Colell et al. 1995) and in addition the participants make (receive) transfer payments. One of the key features of the Pivot mechanism is that an agent receives a non-zero additional transfer payment only if he is "pivotal" in the sense that his report alters the social decision. While the PMN mechanism also satisfies this feature (in fact, Assumption 1 implies that all agents are pivotal), the Pivot mechanism does not satisfy our no-play-no-pay condition since agents can be charged even if the project is not undertaken. One of the attractive features of Pivot mechanisms for public choice problems is that they always run a "budget surplus." In contrast, the PMN mechanism runs a deficit in real terms in the sense that the sum of all divisional charges, discounted at the firm's cost of capital, r, is less than the initial investment expenditure.

To conclude this section, we demonstrate that the PMN mechanism can be extended to settings in which Assumption 1 does not hold. The immediate issue then is that the critical profitability cutoffs $\theta_i^*(\theta_{-i})$ may be less than $\underline{\theta}_i$. We extend the PMN mechanism to environments satisfying the following weaker form of Assumption 1.

Assumption 2: For all θ, there exists some division i such that $\theta_i^*(\theta_{-i}) \geq \underline{\theta}_i$.

Thus, for all type profiles θ, there must be *at least one* essential division. Assumption 2 is likely to be satisfied in settings where there are either one or a few larger divisions (in terms of the magnitude of their PV_i's) whose valuation is critical for the project's overall profitability. Given Assumption 2, the PMN mechanism can be modified by replacing $\theta_i^*(\theta_{-i})$ with $\max\{\underline{\theta}_i, \theta_i^*(\theta_{-i})\}$. As a consequence, nonessential agents, for whom $\theta_i^*(\theta_{-i}) < \underline{\theta}_i$, will be assigned an ownership share $\lambda_i(\theta) = 0$. While the modified PMN mechanism is again satisfactory, it is no longer the unique solution among the class of capital budgeting mechanisms we consider. In particular, it is not necessary that nonessential divisions be charged zero. However, uniqueness of this modified PMN mechanism can be restored if one imposes an additional participation constraint akin to Moulin's (1986) "no-free-ride" condition. Specifically, this *ex post* participation condition requires that no division be worse off by participating in the mechanism. As a consequence, nonessential divisions must then be charged zero.

Exclusive Assets

We now examine the design of capital budgeting mechanisms for a setting in which the divisions face a limited capital budget. For simplicity, we suppose that the capital budget is sufficient to fund at most one of the divisional projects.[17] One interpretation of this specification is that, while the firm's capital cost for financing a single project is r, this cost would increase sufficiently fast with additional investments such that the additional cash returns could not possibly cover the higher cost of capital. An alternative interpretation is that the firm has already decided to undertake a particular project, e.g., the firm has entered into a procurement contract, yet the capital budgeting process is to determine that of the n divisions could implement this project most profitably.

Division i's investment opportunity requires an initial cash outlay of b_i. The NPV of division i's investment project is then given by:

$$NPV_i(\theta_i) \equiv PV_i(\theta_i) - b_i.$$

As before, the profitability parameters θ_i are divisional private information. Division i's internal rate of return is denoted by $r_i^o(\theta_i)$; that is:

$$\sum_{t=1}^{T} (1 + r_i^o(\theta_i))^{-t} \cdot x_{it} \cdot \theta_i = b_i. \tag{14}$$

The first-best investment decision rule calls for selecting the highest NPV project provided that NPV is positive; i.e., the corresponding internal rate of return exceeds the firm's cost of capital r.

We use the indicator variable $I_i \in \{0, 1\}$ to represent whether division i's investment project is undertaken. Given our specification that the firm can fund at most one project, a feasible investment policy must satisfy $\Sigma_{i=1}^{n} I_i \leq 1$. A capital budgeting mechanism for exclusive assets specifies:

- An investment decision rule, $I_i : \Theta \rightarrow \{0, 1\}$ such that $\Sigma_{i=1}^{n} I_i(\theta) \leq 1$. Division i's beginning balance equals $A_{i0} = b_i \cdot I_i(\theta)$;
- A capital charge rate, $\hat{r} : \Theta \rightarrow (-1, \infty)$; and
- A depreciation schedule, $d_i : \Theta \rightarrow R^T$, satisfying $\Sigma_{t=1}^{T} d_{it}(\theta) = 1$ if $I_i(\theta) = 1$, and $d_{it}(\theta) \equiv 0$ if $I_i(\theta) = 0$.

Note that this class of mechanisms again imposes a no-play-no-pay condition, since a division can be charged only if its project receives funding.[18] In direct analogy to our earlier terminology, a capital budgeting mechanism is said to be *satisfactory* if (i) it is strongly incentive compatible for each manager, and (ii) it selects the highest positive NPV project.

It will be notationally convenient to denote the highest positive NPV project by:

$$NPV^1(\theta) \equiv \max_i \{NPV_i(\theta_i), 0\}.$$

Efficient project selection requires that $I_i^*(\theta) = 1$ only if $NPV^1(\theta) = NPV_i(\theta_i)$. We also define:

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[17] It is readily seen that the mechanisms we identify in this subsection can be extended to settings where the firm can fund k out of n possible projects. However, such an extension would add significant clutter to the notation without adding any substantive insight.

[18] Because division i will be burdened with depreciation and capital charges only if $I_i = 1$, it is without loss of generality to set a uniform, firmwide capital charge rate $\hat{r}(\cdot)$.

$$NPV^1(\theta_{-i}) = \max_{j \neq i}\{NPV_j(\theta_j), 0\}.$$

For a given θ_{-i}, let $\theta_i^*(\theta_{-i})$ denote the lowest value of division i's profitability parameter for which its project is at least as profitable as any of the other $n - 1$ projects. That is:

$$NPV_i(\theta_i^*(\theta_{-i})) = NPV^1(\theta_{-i}).$$

Put differently, at $\theta_i = \theta_i^*(\theta_{-i})$, division i's *NPV* would just tie with the highest *NPV* of the remaining divisions, provided that value is positive.[19] Note that this definition of $\theta_i^*(\theta_{-i})$ implies that $I_i^*(\theta) = 1$ only if $\theta_i \geq \theta_i^*(\theta_{-i})$.[20]

The following capital budgeting mechanism will be referred to as the *Competitive Hurdle Rate* (CHR) mechanism:

(i) $I_i(\theta) = I_i^*(\theta)$;
(ii) $\hat{r} = r^*(\theta) \equiv r_i^o(\theta_i^*(\theta_{-i}))$ if $I_i^*(\theta) = 1$; and
(iii) $\{d_{it}(r^*(\theta))\}_{t=1}^T$ is the relative benefit depreciation schedule based on the competitive hurdle rate $r^*(\theta)$.

The competitive hurdle rate, $r^*(\theta)$, is the internal rate of return of the winning division evaluated at the critical profitability type, $\theta_i^*(\theta_{-i})$. Division i's report does not affect the competitive hurdle rate provided $\theta_i > \theta_i^*(\theta_{-i})$. The CHR mechanism simplifies considerably when all divisions are *ex ante* identical with regard to X_i and b_i. The rank order of the *NPV*s then is identical to the rank order of the internal rates of return and therefore the competitive hurdle rate for the winning division simply equals the second-highest internal rate of return: $r_i^* = \max_{j \neq i}\{r_j^o(\theta_j), r\}$. In this context, it is also readily seen that the CHR mechanism can be viewed as a delegation mechanism: divisions report their internal rates of return and decide on their own whether to proceed with their divisional projects with the capital charge rate set at the second-highest reported internal rate of return.

The relative benefit depreciation schedule in (iii) ensures that the cost charge to division i is given by $z_{it}(\theta) \cdot b_i = x_{it} \cdot [\Sigma_{\tau=1}^T [1 + r_i^o(\theta_i^*(\theta_{-i}))]^{-\tau} \cdot x_{i\tau}]^{-1} \cdot b_i$. It then follows from Equation (14) that the charge to division i is given by:

$$z_{it}(\theta) \cdot b_i = x_{it} \cdot \theta_i^*(\theta_{-i}) \tag{15}$$

and hence, $\pi_{it}(\theta) \equiv \pi_{it}(\theta_i, \theta_{-i}|\theta_i) = x_{it} \cdot [\theta_i - \theta_i^*(\theta_{-i})] \cdot I_i(\theta)$. Therefore, the CHR mechanism provides strong incentives for each manager to report his information truthfully.

Proposition 2: The Competitive Hurdle Rate (CHR) mechanism is the unique satisfactory capital budgeting mechanism for exclusive assets.

To see the uniqueness of the CHR mechanism, consider again the case where divisional managers receive a constant share of residual income in each period as compensation and they discount future payoffs at the firm's cost of capital r. Since any satisfactory dominant-strategy mechanism must then be a Groves mechanism, we have:

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[19] While $\theta_i^*(\theta_{-i})$ depends on all distributional cash flow parameters $(X_1,\ldots,X_n)$ and on the cash outlay amounts $(b_1,\ldots,b_n)$, we suppress this dependence for notational ease.

[20] To rule out uninteresting corner solutions and to ensure the critical profitability type $\theta_i^*(\theta_{-i})$ is always well defined for all θ_{-i}, we assume throughout that, for all i, $NPV_i(\underline{\theta}_i) = L$ and $NPV_i(\theta_i) = H$ for some $H > L$.

$$\sum_{t=1}^{T} \gamma^t \cdot z_{it}(\theta) \cdot b_i = -\sum_{j \neq i} NPV_j(\theta_j) \cdot I_j^*(\theta) + h_i(\theta_{-i}), \tag{16}$$

where $h_i(\cdot)$ is an arbitrary function of θ_{-i}. The total surplus of the remaining $n - 1$ divisions, given by the first term on the right-hand side of Equation (16), is equal to 0 when $I_i(\theta_i) = 1$, and equal to $NPV^1(\theta_{-i})$ when $I_i^*(\theta) = 0$. Equation (16) can therefore be written as:

$$\sum_{t=1}^{T} \gamma^t \cdot z_{it}(\theta) \cdot b_i = -NPV^1(\theta_{-i}) \cdot [1 - I_i^*(\theta)] + h_i(\theta_{-i}).$$

The no-play-no-pay condition immediately implies that $h_i(\theta_{-i}) = NPV^1(\theta_{-i})$ and therefore:

$$\begin{aligned} \sum_{t=1}^{T} \gamma^t \cdot \pi_{it} &= [NPV_i(\theta_i) - NPV^1(\theta_{-i})] \cdot I_i^*(\theta_i, \theta_{-i}) \\ &= \sum_{t=1}^{T} \gamma^t \cdot x_{it} \cdot [\theta_i - \theta_i^*(\theta_{-i})] \cdot I_i^*(\theta_i, \theta_{-i}). \end{aligned} \tag{17}$$

Equation (17) shows that when all divisions discount future payoffs at the principal's cost of capital, r, a satisfactory capital budgeting mechanism for exclusive assets must take the form of a second-price auction in which the present value of all charges to the winning division is the second highest *NPV*. Strong incentive compatibility requires that the managerial performance measure reflects the divisional *NPV* not only over the entire planning horizon, but also on a period-by-period basis. As a consequence, the aggregate cost charge must be annuitized as in Equation (15). Uniqueness of the CHR mechanism now follows from the fact that the competitive hurdle rate combined with the relative benefit depreciation implement the cost charges in Equation (15) and, by Lemma 1, there can be only one such solution.

The CHR mechanism is a multiperiod version of the Pivot mechanism. It is well known from the public choice literature that Pivot mechanisms always attain a budget surplus in the sense that the sum of all monetary transfers to the agents, in addition to cost-sharing payments, is negative. Accordingly, we obtain the following result.

Corollary 3: The hurdle rate under the CHR mechanism, $r^*(\theta)$, exceeds the firm's cost of capital, r.

We note that Propositions 1 and 2 differ markedly in their prescriptions regarding the capital charge rates. In order to obtain strong incentives within the class of accounting-based mechanisms we consider, the capital charge rate for shared assets must be lower than the owner's cost of capital (Corollary 1), while the reverse conclusion is obtained for exclusive assets.[21] While the usual comprehensive income measurement conditions $\Sigma_{t=1}^{T} d_{it} = 1$ and $A_{i0} = b_i \cdot I_i$ hold, the investment expenditure is less than the present value of the cost charges to the winning division, discounted at the firm's cost of capital, r:

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[21] Corollary 3 seems at odds with the results in Bareket and Mohnen (2007) who also consider the problem of picking one among several mutually exclusive projects, yet in their model the hurdle rate can be kept at r. The essential difference between the models is that we consider multiple divisions competing for funds, whereas in Bareket and Mohnen (2007) a single division can have only one of several projects approved. Daugart (2005) studies decision problems in which projects impose externalities on other divisions and argues that in such settings goal-congruent performance measures require depreciation rules that differ from the relative benefit rule.

$$\sum_{t=1}^{T} (1 + r)^{-t} \cdot z_{it}(\theta) \cdot b_i > \sum_{t=1}^{T} (1 + r^*)^{-t} \cdot z_{it}(\theta) \cdot b_i = b_i.$$

If one were to impose the requirement that the capital charge rate be equal to the firm's cost of capital, i.e., $\hat{r}(\theta) \equiv r$, then incentive compatibility would require a departure from comprehensive income measurement. Specifically, the same incentives could be generated by capitalizing the initial amount $A_{i0} = PV_i(\theta_i^*(\theta_{-i}))$ for the winning division, yet this amount would exceed the actual investment expenditure b_i.

III. HIDDEN ACTIONS AND INCENTIVE CONTRACTING

Second-Best Mechanisms

Our analysis has so far taken as given that divisional managers seek to maximize their performance measures and that the objective of the central office is to maximize the firm-wide *NPV* by choice of goal-congruent performance measures. It is natural to ask which properties of goal-congruent mechanisms carry over to second-best mechanisms once we include an explicit agency problem and the desired incentives are derived from a unified optimization program. Specifically, suppose divisional operating cash flow in period t is now given by:

$$c_{it} = a_{it} + x_{it} \cdot \theta_i \cdot I_i,$$

where $a_{it} \in [0, \bar{a}_{it}]$ denotes productive effort chosen privately by manager i in period t and $I_i \in \{0, 1\}$ indicates generically (for shared and exclusive assets) whether division i has access to the asset. Manager i observes θ_i before contracting. The central office and all other managers share the same beliefs about θ_i given by the cumulative distribution, $F_i(\theta_i)$, with strictly positive density, $f_i(\theta_i)$, over the entire support Θ_i.[22] We assume the usual monotone inverse hazard rate condition; i.e., $H_i(\theta_i) \equiv [1 - F_i(\theta_i)]/f_i(\theta_i)$ is decreasing in θ_i for all i. While the central office can observe the divisional operating cash flows in each period, it is unable to disentangle the investment-related from the effort-related components.

Manager i's date 0 utility payoff is given by:

$$U_i = \sum_{t=1}^{T} \gamma^t \cdot [s_{it} - v_{it}(a_{it})],$$

where s_{it} denotes his compensation in period t and $v_{it}(\cdot)$ is his disutility from exerting effort a_{it} in period t. The function v_{it} is increasing and convex with $v_{it}'(0) = 0$, for all i and t. Given this structure, it is only the present value of compensation payments that matters to each manager, provided all parties can commit to a T period contract.

In our setting, a revelation mechanism specifies an investment decision rule $I_i(\tilde{\theta}) \in \{0, 1\}$, "target cash flows" $c_i(\tilde{\theta}) \equiv (c_{i1}(\tilde{\theta}),...,c_{iT}(\tilde{\theta}))$ to be delivered by each division, and managerial compensation payments $s_i(\tilde{\theta}) \equiv (s_{i1}(\tilde{\theta}),...,s_{iT}(\tilde{\theta}))$, contingent on the reports $\tilde{\theta}$. For any such mechanism, let $U_i(\tilde{\theta}_i, \tilde{\theta}_{-i}|\theta_i)$ denote manager i's utility contingent on his own true profitability parameter θ_i, reports $\tilde{\theta}_{-i}$ submitted by the other managers, and his own report $\tilde{\theta}_i$. Given truthful reporting on the part of the other managers, this yields:

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[22] Alternatively, managers may learn their θ_i parameters after entering into the contract, but they cannot be prevented from quitting the job if their participation constraints are not satisfied.

$$U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i) \equiv \sum_{t=1}^{T} \gamma^t \cdot [s_{it}(\tilde{\theta}_i, \theta_{-i}) - v_{it}(a_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i))],$$

where $a_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) \equiv \min\{a_{it}|a_{it} + x_{it} \cdot \theta_i \cdot I_i(\tilde{\theta}_i, \theta_{-i}) \geq c_{it}(\tilde{\theta}_i, \theta_{-i})\}$ is the minimum effort that manager i has to exert so as to achieve the required periodic cash flow target $c_{it}(\tilde{\theta}_i, \theta_{-i})$ in each period.

By the Revelation Principle we may restrict attention to mechanisms that induce managers to reveal their information truthfully. The central office's optimization problem can then be stated as follows:

$$\mathbf{P}: \max_{(c_i(\theta), s_i(\theta), I_i(\theta))_{i=1}^{n}} E_\theta \left\{ \sum_{i=1}^{n} \sum_{t=1}^{T} \gamma^t \cdot [c_{it}(\theta) - s_{it}(\theta)] - B(\theta) \right\} \tag{18}$$

subject to:

(i_e) for exclusive assets: $\Sigma_{i=1}^{n} I_i(\theta) \leq 1$ and $B(\theta) = \Sigma_{i=1}^{n} b_i \cdot I_i(\theta)$;
(i_s) for shared assets: $I_i(\theta) = I_j(\theta) = I(\theta)$, for all i, j, and $B(\theta) = b \cdot I(\theta)$;
(ii) $E_{\theta_{-i}} [U_i(\theta_i, \theta_{-i}|\theta_i)] \geq E_{\theta_{-i}} [U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i)]$, for all $\theta_i, \tilde{\theta}_i$ and i; and
(iii) $E_{\theta_{-i}} [U_i(\theta_i, \theta_{-i}|\theta_i)] \geq 0$, for all θ_i and i.

Constraints (i_e) and (i_s) ensure feasibility of the investment rule for exclusive and shared assets, respectively, and specify the resulting initial investment amounts. The incentive compatibility constraints (ii) require that truthful reporting constitute a Bayesian-Nash equilibrium. The participation constraints (iii) are required to hold on an interim basis, i.e., each manager must break even in expectation over the other managers' possible types. We denote the solution to this program by $(c_i^*(\theta), s_i^*(\theta), I_i^*(\theta))_{i=1}^{n}$ and refer to it as the *second-best solution.*

A manager can underreport $\tilde{\theta}_i < \theta_i$ and at the same time reduce his effort whenever $I_i(\tilde{\theta}_i, \theta_{-i}) = 1$. Therefore, managers will earn informational rents on account of their private information. The basic trade-off for the central office is that manager i's information rents will be increasing both in the induced effort levels, $(a_{i1}, \ldots, a_{iT})$, as well as in the set of states in which division i has access to the asset. Applying standard arguments from the adverse selection literature based on "local" incentive constraints (e.g., Laffont and Tirole 1993), it can be shown that manager i's interim informational rent for any θ_i (i.e., in expectation over other managers' types) equals:

$$E_{\theta_{-i}} [U(\theta_i, \theta_{-i}|\theta_i)] = E_{\theta_{-i}} \left[\int_{\underline{\theta}_i}^{\theta_i} \sum_{t=1}^{T} \gamma^t \cdot v_{it}'(a_{it}(q_i, \theta_{-i}|q_i)) \cdot x_{it} \cdot I_i(q_i, \theta_{-i}) dq_i \right]. \tag{19}$$

Equation (19) illustrates the above trade-off: manager i's informational rent can be reduced either by creating lower powered effort incentives (there will be no rent if $a_{it} = 0$) or by curtailing the set of states θ in which $I_i(\theta) = 1$.

To simplify the exposition and sharpen our predictions regarding the second-best investment decision rule, we focus on a setting in which the central office always finds it worthwhile to induce maximum effort in each period, i.e., $a_{it}^*(\theta_i, \theta_{-i}|\theta_i) \equiv \bar{a}_{it}$. Inducing the maximum level of effort will indeed be optimal provided $v_{it}'(\bar{a}_{it})$ is sufficiently small relative to the other parameters of the model. For brevity, we denote $v_{it}' \equiv v_{it}'(\bar{a}_{it})$. As shown in Appendix B, the following condition ensures that the central office will indeed seek to induce the maximum level of effort in each period:

$$1 - v'_{it} - v''_{it}(\bar{a}_{it}) \cdot x_{it} \cdot H_i(\underline{\theta}_i) \geq 0, \tag{20}$$

for each i and t. Condition (20) says that even if division i has access to the asset for all $\theta_i \geq \underline{\theta}_i$, the marginal return from effort, which has been normalized to 1, is sufficiently large for the central office to prefer high effort despite the corresponding increase in expected informational rents. We will discuss below how our results would be affected if Condition (20) were relaxed so that interior levels of effort would be optimal.

We use Equation (19), evaluated at $a_{it} = \bar{a}_{it}$, to solve for each manager's compensation payments $s_{it}(\theta)$ in **P**. The central office's optimization problem then simplifies to the following program (see Appendix B for a detailed derivation):

$$\mathbf{P}': \max_{(I_i(\theta))_{i=1}^{n}} E_\theta \left\{ \sum_{i=1}^{n} \left[\sum_{t=1}^{T} \gamma^t \cdot [\bar{a}_{it} - v_{it}(\bar{a}_{it})] + [PV_i(\theta_i) - \kappa_i \cdot H_i(\theta_i)] \cdot I_i(\theta) \right] - B(\theta) \right\},$$

subject to (i_e), (i_s),

where $\kappa_i \equiv \Sigma_{t=1}^{T} \gamma^t \cdot v'_{it} \cdot x_{it}$. The reduced objective function in $\mathbf{P}'$ reflects that the expected value of manager i's interim informational rents (i.e., $E_\theta[U(\theta_i, \theta_{-i}|\theta_i)]$) is equal to the expected value of $\kappa_i \cdot H_i(\theta_i) \cdot I_i(\theta)$.

To characterize the second-best investment decision rule, it will be useful to define:

$$\phi_i(\theta_i) \equiv PV_i(\theta_i) - \kappa_i \cdot H_i(\theta_i) \tag{21}$$

as the present value of division i's *virtual* cash flows (i.e., the present value of cash flows net of the manager's informational rents). The second-best investment rule for exclusive assets then is given by $I_i(\theta) = 1$ if and only if:

$$VNPV_i(\theta_i) \geq \max_j \{VNPV_j(\theta_j), 0\}, \tag{22}$$

for $VNPV_i(\theta_i) \equiv \phi_i(\theta_i) - b_i$ as the *virtual divisional* NPV. Let $VNPV(\theta) \equiv \Sigma_{i=1}^{n} \phi_i(\theta_i) - b$ denote the *virtual corporate NPV*, so that the second-best investment rule for shared assets requires:

$$VNPV(\theta) \geq 0. \tag{23}$$

We now demonstrate that the satisfactory mechanisms identified in Section II can be adapted to generate optimal incentives in the presence of agency problems. A capital budgeting mechanism is said to be *optimal* if and only if there exist linear compensation schemes:

$$\{s_{it}(\pi_{it}|\tilde{\theta}) = \alpha_{it}(\tilde{\theta}) + \beta_{it}(\tilde{\theta}) \cdot \pi_{it}(\cdot)\}, \tag{24}$$

for all $1 \leq t \leq T$ and $1 \leq i \leq n$, that achieve the same payoff for the principal as the second-best mechanism identified above.

Optimal Mechanisms: Exclusive Assets

The second-best investment rule calls for funding a project if and only if its *virtual NPV* exceeds both zero and the virtual *NPV*s of all other projects. That is, $I_i(\theta) = 1$, if and only if $VNPV_i(\theta_i) = VNPV^1(\theta)$ where $VNPV^1(\theta) \equiv \max_{1 \leq j \leq n}\{VNPV_j(\theta_j), 0\}$. Accordingly, we now denote the *agency-adjusted* profitability cutoff for division i by $\theta_i^{**}(\theta_{-i})$ that is implicitly defined by:[23]

$$VNPV_i(\theta_i^{**}(\theta_{-i})) = VNPV^1(\theta_{-i}).$$

The corresponding agency-adjusted competitive hurdle rate of division i, $r_i^{**}(\theta)$, is defined to be the internal rate of return of its agency-adjusted critical project:

$$r_i^{**}(\theta) \equiv r_i^o(\theta_i^{**}(\theta_{-i})). \tag{25}$$

Suppose now that each manager is offered a linear compensation scheme of the form in Equation (24) with bonus coefficients $\beta_{it} = v'_{it}$. If the performance measure is based on the competitive hurdle rate mechanism (i.e., the capital charge rate is equal to the agency-adjusted competitive hurdle rate and the asset valuation is based on the relative benefit depreciation rule), then:

$$\pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) = v'_{it} \cdot I_i(\tilde{\theta}_i, \theta_{-i}) \cdot x_{it} \cdot [\theta_i - \theta_i^{**}(\theta_{-i})]. \tag{26}$$

Each manager has dominant-strategy incentives to report his information truthfully because a project makes a positive contribution to his performance measure if and only if $\theta_i > \theta_i^{**}(\theta_{-i})$. Our next result shows that this mechanism is indeed optimal. Furthermore, even though the optimization program in **P** is stated in terms of Bayesian-Nash incentive compatibility and interim participation constraints, the central office obtains dominant strategy incentives and *ex post* satisfaction of the participation constraints for "free." This characterization applies to a broader class of mechanisms (Mookherjee and Reichelstein 1992).[24]

Proposition 3: The Competitive Hurdle Rate (CHR) mechanism based on the agency-adjusted capital charge rate $\hat{r} = r_i^{**}(\theta)$ is an optimal mechanism.

Equation (26) shows that the present value of the intertemporal cost charges for the winning division is equal to the second highest virtual *NPV*. The CHR mechanism can therefore again be interpreted as a multiperiod version of the second-price auction mechanism. If managers are *ex ante* identical with regard to $F_i(\cdot) \equiv F(\cdot)$, $\kappa_i = \kappa$, $b_i = b$ and $X_i = X$, it will suffice to ask each manager to report his internal rate of return r_i. Denoting by r^c the internal rate of return of a project whose virtual *NPV* is zero, it is then optimal to set the hurdle rate for the winning division equal to $r_i^{**}(r_1,\ldots,r_n) = \max_{j \neq i}\{r_j, r^c\}$. In general, however, the rank order of the divisional internal rates of return need not agree with the rank order of the virtual *NPV*s.

The case of *ex ante* identical managers also illustrates the impact of an exogenous change in the number of divisions competing for the scarce capital. The principal will benefit from increased competition among divisions in two ways. First, the informational rents of the winning manager will be reduced. For instance, with *ex ante* identical agents, the winner's informational rent is given by $U_i(\theta_i, \theta_{-i}|\theta_i) = \kappa \cdot [\theta_i - \theta_i^{**}(\theta_{-i})] = \kappa \cdot [\theta_i - \max_{j \neq i}\{\theta_j, \theta^c\}]$, where θ^c denotes the agency-adjusted break-even profitability in a single-agent setting (i.e., $r^c \equiv r^o(\theta^c)$). Clearly, the winning agent's informational rents are decreasing in n, in expectation. Second, the underinvestment problem will be mitigated. To see this, note that the *ex ante* probability of underinvestment is equal to $[F(\theta^c) - F(\theta^o)]^n$, where θ^o denotes the break-even profitability (i.e., $NPV(\theta^o) = 0$).

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[23] To ensure that well-defined profitability cutoffs exist, we again assume that, for all i, $VNPV_i(\underline{\theta}_i) = L$ and $VNPV_i(\overline{\theta}_i) = H$ for some $H > L$.

[24] Unlike Proposition 2, Proposition 3 only speaks to the sufficiency, and not necessity, of the CHR mechanism. Given that the parties can commit to the contract and they have the same intertemporal preferences, there is considerable indeterminacy in distributing the divisional cost charges across different periods. Additional robustness criteria, like those proposed in Dutta and Reichelstein (2002) or Arya et al. (2005), may narrow the class of "feasible" mechanisms.

A natural question is how the agency-adjusted hurdle rate under the CHR mechanism, $r^{**}(\theta)$, compares with the hurdle rate identified in Proposition 2 in the absence of an explicit agency problem. In single-period capital budgeting problems, such as the one posed in Antle and Eppen (1985), the hurdle rate always increases as the agency problem becomes more severe: the virtual *NPV* of the project decreases while the opportunity cost of investing is given by the firm's cost of capital r, and therefore unaffected. We find that this prediction does not generalize straightforwardly to our multidivisional setting. To illustrate, let $n = 2$.[25] The parameters (κ_1, κ_2) measure the relative severity of the two agency problems. Denoting by $\phi_i(\theta_i|\kappa_i)$ the present value of virtual cash flows as a function of κ_i, division 1's critical type is given by:

$$\phi_1(\theta_1^{**}(\theta_2|\kappa_1, \kappa_2)|\kappa_1) - b_1 \equiv \phi_2(\theta_2|\kappa_2) - b_2, \tag{27}$$

and the resulting hurdle rate equals $r_1^{**}(\theta|\kappa_1, \kappa_2) = r_1^o(\theta_1^{**}(\theta_2|\kappa_1, \kappa_2))$. We note from Equation (21) that $\phi_i(\theta_i|\kappa_i)$ is increasing in θ_i and decreasing in κ_i.

In the case of *ex ante* identical agents, i.e., $F_i(\cdot) \equiv F(\cdot)$, $\kappa_i = \kappa$, $b_i = b$, $X_i = X$, for $i = 1, 2$, the condition characterizing division 1's cutoff profitability type in Equation (27) reduces to $\theta_1^{**}(\theta_2|\kappa, \kappa) \equiv \theta_2$. To understand the irrelevance of the agency parameter κ for computing hurdle rates with *ex ante* identical agents, note that an increase in κ reduces the virtual *NPV* of division 1's project, but at the same time it also reduces the opportunity cost (i.e., the virtual *NPV* of division 2's project) by the same amount. As a consequence, hurdle rates are unaffected.

Generalizing this insight, the natural question is whether the hurdle rate can be viewed as an instrument for "handicapping" certain divisions.[26] Consider an exogenous increase in κ_2, i.e., manager 2's agency problem becomes more severe, *ceteris paribus*. As a result, the right-hand side of Equation (27) decreases. To restore the identity, manager 1's cutoff type $\theta_1^{**}(\theta_2|\kappa_1, \kappa_2)$ must go down and so does the competitive hurdle rate $r_1^{**}(\cdot)$. The reverse prediction emerges for an increase in κ_1 since now division 1's virtual *NPV* decreases, which results in a higher profitability cutoff. We summarize these observations in the following corollary.

Corollary 4: For $n = 2$, the agency-adjusted competitive hurdle rate $r_i^{**}(\theta|\kappa_1, \kappa_2)$ under the CHR mechanism is increasing in κ_i, but decreasing in κ_j, $j \neq i$.

The principal thus calibrates the CHR mechanism so as to handicap a division whose agency problem is more severe. In particular, suppose the two projects are *ex ante* identical except that $\kappa_1 > \kappa_2$ so that the firm faces higher agency costs with division 1. Corollary 4 then implies that division 1 will face a higher hurdle rate than division 2. This finding is related to the corporate finance literature on investments in diversified firms (e.g., Shin and Stulz 1998).[27] That literature has pointed to "corporate socialism" insofar as stronger divisions get allocated relatively less capital than weaker divisions, as a result of information asymmetry. This finding has been explained by managers exerting influence activities (Rajan et al. 2000). Our results generate similar empirical predictions, though in our model handicapping "stronger" divisions actually improves overall efficiency. Consider two divisions that are identical in terms of $\kappa_i = \kappa$, $b_i = b$, and $X_i = X$, for $i = 1, 2$, but their profitability types θ_i are drawn from different distributions F_i over identical supports $\Theta_i = \Theta$. In particular, suppose that division 1's type distribution is more favorable in the sense of (inverse) hazard rate dominance: $H_1(y) > H_2(y)$ for all y. Applying similar arguments as in Corollary 4, it can be shown that, all else equal, division 1 will be charged more for its allocated capital. Since division 1's project is more profitable *ex ante* than that of division 2, rent extraction weighs more heavily for division 1's manager with the consequence of a higher hurdle rate.

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[25] The following discussion can be extended in a straightforward fashion to arbitrary n.

[26] The auctions literature has also explored the differential treatment of agents based on differences in their *ex ante* characteristics; see Krishna (2002).

To conclude this section, we demonstrate that the CHR mechanism remains optimal for settings in which the second-best solution entails interior effort choices. When Condition (20) does not hold, the optimal effort choice $a^*_{it}(\theta|\theta_i)$ will satisfy the following first-order condition:

$$1 - v'_{it}(a^*_{it}(\theta|\theta_i)) - v''_{it}(a^*_{it}(\theta|\theta_i)) \cdot x_i \cdot H_i(\theta_i) \cdot I_i(\theta) \geq 0, \tag{28}$$

such that, by complementary slackness, this inequality will hold as an equality when $a^*_{it}(\theta|\theta_i) < \bar{a}_{it}$.[28] Condition (28) shows that the central office may find it optimal to create lower-powered effort incentives in order to economize on the winning division's informational rents. Furthermore, the winning division's effort incentives will increase in its reported productivity type. The reason is that higher-powered incentives for unproductive types result in higher information rents for more favorable type realizations.[29] We note, however, that the second-best investment rule is again given by Equation (22) with $VNPV_i(\theta_i) \equiv PV_i(\theta_i) - b_i - \Sigma_{t=1}^{T} \gamma^t \cdot v'_{it}(a^*_{it}(\theta|\theta_i)) \cdot x_{it} \cdot H_i(\theta_i) \cdot I_i(\theta)$. If the winning division's periodic bonus coefficients are chosen as $\beta_{it}(\theta) = v'_{it}(a^*_{it}\theta|\theta_i))$ and the performance measure is based on the agency-adjusted competitive hurdle rate, a linear compensation scheme of the form in Equation (24) can achieve the same payoffs for the principal as the direct revelation mechanism. Thus, the CHR mechanism remains optimal even when we allow for interior effort choices.[30]

Optimal Mechanisms: Shared Assets

For shared assets, we recall from Equation (23) that the second-best investment decision calls for the joint asset to be acquired if and only if the firmwide virtual NPV is positive. That is, $I(\theta) = 1$, if and only if:

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[27] We thank an anonymous referee for pointing out this connection.

[28] See Appendix B in Dutta and Reichelstein (2002) for a complete derivation in a single agent setting.

[29] A qualitatively similar outcome would obtain if effort and investment productivity were complements, such that $c_{it} = a_{it} \cdot x_{it} \cdot \theta_i \cdot I_i$. As demonstrated in Baldenius and Reichelstein (2005), the second-best bonus coefficients for the winning manager will be an increasing function of his reported type θ_i, provided the periodic cash flows are multiplicatively separable in θ_i and a_{it}.

[30] When Condition (20) holds, only the performance measures $\pi_i(\cdot)$ depend on $\tilde{\theta}$, whereas the fixed salaries and bonus coefficients are independent of the reported types: $\alpha_i(\tilde{\theta}) \equiv \alpha_i$ and $\beta_i(\tilde{\theta}) \equiv \beta_i$. This no longer holds once we allow for interior effort choices because Condition (20) is violated.

$$VNPV(\theta) \equiv \sum_{i=1}^{n} \phi_i(\theta_i) - b \geq 0.$$

In analogy with our definition of $\theta_i^*(\theta_{-i})$, we now define the *agency-adjusted* critical values $\theta_i^{**}(\theta_{-i})$ by:

$$\phi_i(\theta_i^{**}(\theta_{-i})) \equiv b - \sum_{j \neq i} \phi_j(\theta_j). \tag{29}$$

By construction, $\theta_i^{**}(\theta_{-i}) > \theta_i^*(\theta_{-i})$. In the presence of agency costs, the capital charge rate under the PMN mechanism is given by:

$$\hat{r}(\theta) = r^{**}(\theta) \equiv r^o(\theta_1^{**}(\theta_{-1}),\ldots,\theta_n^{**}(\theta_{-n})), \tag{30}$$

and the divisional asset shares are calculated according to:

$$\lambda_i(\theta) = \frac{\Gamma^{**}(\theta) \cdot X_i \cdot \theta_i^{**}(\theta_{-i})}{\Sigma_{i=j}^{n} \Gamma^{**}(\theta) \cdot X_j \cdot \theta_j^{**}(\theta_{-j})}, \tag{31}$$

with $\Gamma^{**}(\theta) \equiv ((1 + r^{**}(\theta))^{-1},\ldots,(1 + r^{**}(\theta))^{-T})$.

If divisional managers are compensated on the basis of linear schemes of the form in (24) with bonus coefficients $\beta_{it} = v'_{it}$, then they have incentives to provide the targeted amount of effort in each period. Furthermore, the PMN mechanism results in the following contribution to manager i's compensation in period t:

$$\beta_{it} \cdot \pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) = \beta_{it} \cdot I_i(\tilde{\theta}_i, \theta_{-i}) \cdot x_{it} \cdot [\theta_i - \theta_i^{**}(\theta_{-i})]. \tag{32}$$

As a consequence, the joint project leaves manager i better off if and only if $\theta_i > \theta_i^{**}(\theta_{-i})$, i.e., $VNPV(\theta) \geq 0$. Truthful reporting therefore again is a dominant-strategy equilibrium and we obtain the following:[31]

Proposition 4: Given Assumption 1, the Pay-the-Minimum-Necessary (PMN) mechanism, based on the agency-adjusted capital charge rate of $r^{**}(\theta)$ in Equation (30) and the asset-sharing rule in Equation (31), is optimal.

In contrast to the exclusive asset scenario, the cutoff condition in Equation (29) implies an unambiguous comparative statics result on how the relative severity of the agency problem affects the capital charge rate.[32] To this end, we again express the hurdle rate $r^{**}(\theta|\kappa_1,\ldots,\kappa_n)$ as a function of the agency cost parameters κ_i.

Corollary 5: The agency-adjusted hurdle rate $r^{**}(\theta|\kappa_1,\ldots,\kappa_n)$ under the PMN mechanism is increasing in κ_i for all i.

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[31] Assumption 1 was introduced in Section II to ensure that the profitability cutoffs are in the interior of the managers' type supports. Since $\theta_i^{**}(\theta_{-i})$ is higher for any positive κ_i than for $\kappa_i = 0$ (i.e., absent a moral hazard problem), Assumption 1 ensures interior cutoffs also in the presence of agency problems.

[32] Based on the similar arguments as in the exclusive asset case, it can be easily shown that the PMN mechanism remains optimal even when we allow for interior effort choices.

As the agency problem for any division becomes more severe, its contribution $\phi_i(\cdot)$ to the total virtual *NPV* declines. This in turn has a negative externality on the other divisions reflected in a higher capital charge rate. It is straightforward to show that for sufficiently high agency costs (high κ_i's), the resulting agency-adjusted hurdle rate, $r^{**}(\theta)$, will exceed the firm's cost of capital r. Conversely, by continuity our result in Corollary 1 shows that the hurdle rate $r^{**}(\theta)$ will be below r for sufficiently low levels of agency costs.

IV. CONCLUSION

Interdependencies between divisions are ubiquitous when firms make capital budgeting decisions. The framework developed in this paper allows for positive externalities (shared assets) or negative externalities (exclusive assets) among the divisions. Our analysis has illustrated commonalities between these two scenarios as well as distinct differences, in particular with regard to the emerging hurdle rates. We found that capital charge rates without managerial moral hazard tend to exceed the cost of capital r for exclusive assets, while the reverse holds for shared assets. As incentive problems become more severe, the hurdle rate will go up unambiguously for shared assets, but not necessarily so for exclusive assets. Our analysis generates a rich set of predictions regarding the cross-sectional variation in hurdle rates, which may prove useful in future empirical research in this area.

For the exclusive asset setting, our analysis has taken it as given that the firm faces a fixed investment budget that forces capital rationing. While this approach appears descriptive of actual practice in many firms, it would be instructive to examine a more continuous problem in which a firm faces the trade-off that more capital spending results in a higher cost of capital for all funded projects. Such an approach seems particularly appealing in settings where the decisions regarding divisional projects are not binary, but instead the scale of the project is also a choice variable.

Most long-term investment projects involve multiple rounds of funding. In such settings, it is likely that the participating divisions will receive new information at intermediate dates, raising additional cost allocation issues, such as full cost versus successful efforts accounting.[33] Sequential investment problems also raise the question of how hurdle rates evolve over time. It would be desirable to develop a theory that predicts how abandonment or growth options should be managed for common assets that benefit multiple divisions within a firm.[34]

Another promising avenue for future research is to relax our assumption of risk neutrality. As mentioned in the Introduction, earlier work for single-agent models has investigated how capital charge rates should be set for risk-averse managers who face risky projects (see Christensen et al. 2002; Dutta and Reichelstein 2002). In multidivisional firms aggregate firm risk also becomes a coordination issue. To that end, Stoughton and Zechner (2004) explore negative externalities across divisions as higher aggregate risk may necessitate a higher proportion of relatively expensive equity (rather than debt) capital. In contrast, Homburg and Scherpereel (2004) emphasize positive externalities across divisions due to possible diversification effects. Either way, incremental risk must be charged for as part of the capital budgeting process.

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[33] For an analysis of these issues in a single agent setting, see Dutta and Reichelstein (2005).

[34] Arya and Glover (2001), Friedl (2003), and Pfeiffer and Schneider (2007) examine incentive issues for abandonment and growth options in single agent settings.

APPENDIX A
PROOFS

Proof of Proposition 1

We first prove that the PMN mechanism is a satisfactory mechanism. Under the PMN mechanism, division i's performance measure in period t is given by:

$$\begin{aligned}\pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) &= [x_{it} \cdot \theta_i - z_{it}(\tilde{\theta}_i, \theta_{-i}) \cdot \lambda_i(\tilde{\theta}_i, \theta_{-i}) \cdot b] \cdot I^*(\tilde{\theta}_i, \theta_{-i})\\ &= x_{it} \cdot \left[\theta_i - \frac{b}{\Gamma^*(\tilde{\theta}_i, \theta_{-i}) \cdot X_i} \cdot \lambda_i(\tilde{\theta}_i, \theta_{-i})\right] \cdot I^*(\tilde{\theta}_i, \theta_{-i}).\end{aligned}$$

Since $\lambda_i(\tilde{\theta}_i, \theta_{-i}) = \frac{\Gamma^*(\tilde{\theta}_i, \theta_{-i}) \cdot X_i \cdot \theta_i^*(\theta_{-i})}{\Sigma_{j=1}^n \Gamma^*(\tilde{\theta}_i, \theta_{-i}) \cdot X_j \cdot \theta_j^*(\theta_{-j})}$ and the denominator is just equal to b, by the definition of the internal rate of return, manager i's performance measure in period t takes the form:

$$\pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) = x_{it} \cdot [\theta_i - \theta_i^*(\theta_{-i})] \cdot I^*(\tilde{\theta}_i, \theta_{-i}). \tag{33}$$

From (33), we note that in each period, manager i's payoff depends on his own report $\tilde{\theta}_i$ only through its impact on the decision rule $I^*(\cdot)$. Furthermore, (33) shows that each manager has *strong* incentives to induce $I^* = 1$ when $\theta_i \geq \theta_i^*(\theta_{-i})$, and $I^* = 0$ when $\theta_i < \theta_i^*(\theta_{-i})$. Consequently, the PMN mechanism satisfies our requirement of strong incentive compatibility:

$$\pi_{it}(\theta_i, \theta_{-i}|\theta_i) \geq \pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i),$$

for all i, t, θ_i, $\tilde{\theta}_i$, and θ_{-i}.

We now prove the necessity part, i.e., the PMN mechanism is the unique satisfactory mechanism in the class described in (5). We first show that, for a given asset allocation rule $\{\lambda_i\}_{i=1}^n$, any strongly incentive compatible mechanism must have the property that for all $\theta_i > \theta_i^*(\theta_{-i})$:

$$z_{it}(\theta_i, \theta_{-i}) = \frac{x_{it} \cdot \theta_i^*(\theta_{-i})}{\lambda_i \cdot b}. \tag{34}$$

If u_i can vary in some open neighborhood, strong incentive compatibility implies directly that for any $\theta_i > \theta_i^*(\theta_{-i})$ and $\tilde{\theta}_i > \theta_i^*(\theta_{-i})$:

$$z_{it}(\tilde{\theta}_i, \theta_{-i}) = z_{it}(\theta_i, \theta_{-i}).$$

Suppose now that for some period t:

$$z_{it}(\theta_i^*(\theta_{-i}), \theta_{-i}) = \frac{x_{it} \cdot \theta_i^*(\theta_{-i})}{\lambda_i \cdot b} + \Delta_t(\theta_{-i}).$$

If division i's profitability parameter is $\tilde{\theta}_i = \theta_i^*(\theta_{-i}) + \varepsilon_i$, incentive compatibility requires that:

$$\sum_{t=1}^{T} u_{it} \cdot [\varepsilon_i \cdot x_{it} - \Delta_t(\theta_{-i}) \cdot \lambda_i \cdot b] \geq 0.$$

Conversely, for $\tilde{\theta}_i = \theta_i^*(\theta_{-i}) - \varepsilon_i$ incentive compatibility requires:

$$\sum_{t=1}^{T} u_{it} \cdot [-\varepsilon_i \cdot x_{it} - \Delta_t(\theta_{-i}) \cdot \lambda_i \cdot b] \leq 0.$$

Since both of the above inequalities have to hold for any $\varepsilon_i > 0$ and for all u_i in some open neighborhood, (34) must hold. Finally, by Lemma 1 there exist a unique capital charge rate, $\hat{r}$, and a unique depreciation schedule, d, implementing the intertemporal cost allocation:

$$z_i(\theta) = \left(x_{i1} \cdot \frac{\theta_i^*(\theta_{-i})}{\lambda_i(\theta) \cdot b}, \ldots, x_{iT} \cdot \frac{\theta_i^*(\theta_{-i})}{\lambda_i(\theta) \cdot b} \right).$$

It remains to demonstrate the uniqueness of the asset-sharing rule, $(\lambda_i(\theta), \ldots, \lambda_n(\theta))$. Relative benefit depreciation ensures that:

$$\begin{aligned} x_{it} \cdot \theta_i^*(\theta_{-i}) &= z_{it}(\theta) \cdot \lambda_i(\theta) \cdot b \\ &= \frac{x_{it}}{\Gamma^*(\theta) \cdot X_i} \cdot \lambda_i(\theta) \cdot b. \\ \Leftrightarrow \lambda_i(\theta) &= \frac{\Gamma^*(\theta) \cdot X_i \cdot \theta_i^*(\theta_{-i})}{b} \\ &= \frac{\Gamma^*(\theta) \cdot X_i \cdot \theta_i^*(\theta_{-i})}{\Sigma_{j=1}^{n} \Gamma^*(\theta) \cdot X_j \cdot \theta_j^*(\theta_{-j})}. \end{aligned}$$

Proof of Lemma 1

For any given $z \equiv (z_1, \ldots, z_T) \in R_+^T$, the mapping:

$$f_t(d, \hat{r}) \equiv d_t + \hat{r} \cdot \left(1 - \sum_{\tau=1}^{t-1} d_\tau \right) = z_t \tag{35}$$

defines a set of T nonlinear equations in $(d, \hat{r})$. We show that the above system of equations has a unique solution in $D \times (-1, \infty)$ for each $z \in R_+^T$. Solving the first $T - 1$ equations in (35) recursively for $(d_1, \ldots, d_{T-1})$, we get:

$$d_t = z_t + \hat{r} \cdot z_{t-1} + \hat{r}(1 + \hat{r})z_{t-2} + \ldots + \hat{r}(1 + \hat{r})^{t-2}z_1 - \hat{r}(1 + \hat{r})^{t-1}, \tag{36}$$

for $t = 1, \ldots, T - 1$. Substituting this solution into the last component of Equation (35) gives:

$$\begin{aligned} z_T = (1 + \hat{r}) \cdot [&(1 + \hat{r})^{T-1} - (1 + \hat{r})^{T-2} \cdot z_1 - (1 + \hat{r})^{T-3} \cdot z_2 \\ &- \ldots - (1 + \hat{r}) \cdot z_{T-2} - z_{T-1}]. \end{aligned}$$

Multiplying both sides by $\hat{\gamma}^T \equiv (1 + \hat{r})^{-T}$ and simplifying, this last equation reduces to:

$$\sum_{t=1}^{T} \hat{\gamma}^t \cdot z_t = 1. \tag{37}$$

For any $z \equiv (z_1,\ldots,z_T) \in R^T_+$, the polynomial $\Sigma_{t=1}^T \hat{\gamma}^t \cdot z_t$ is increasing in $\hat{\gamma}$ and therefore (37) will be satisfied for a unique $\hat{r}$. In conjunction with (36) this shows that there is a unique solution to the system of T equations.

Proof of Corollary 2

Since $\Sigma_{j=1}^n \Gamma^*(\theta) \cdot X_j \cdot \theta_j^*(\theta_{-j}) = b$, the asset-sharing rule in the PMN mechanism simplifies to $\lambda_i(\theta) = \frac{\Gamma^*(\theta) \cdot X_i \cdot \theta_i^*(\theta_{-i})}{b}$. To prove the result, therefore, it suffices to show that $r^*(\theta)$ is decreasing in θ_i. This follows because:

$$r^*(\theta) = r^o(\theta_1^*(\theta_{-1}),\ldots,\theta_n^*(\theta_{-n})),$$

$r^o(\cdot)$ is increasing in each of its arguments, and $\theta_j^*(\theta_{-j})$ is decreasing in θ_i for all $i \neq j$.

Proof of Proposition 2

We again begin with the sufficiency part. Under the competitive hurdle rate mechanism, period t performance measure is given by:

$$\begin{aligned}\pi_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) &= \left(x_{it} \cdot \theta_i - \frac{x_{it}}{\Sigma_{\tau=1}^T [1 + r_i^o(\theta_i^*(\theta_{-i}))]^{-\tau} \cdot x_{it}} \cdot b_i\right) \cdot I_i^*(\tilde{\theta}_i, \theta_{-i}) \\ &= x_{it} \cdot [\theta_i - \theta_i^*(\theta_{-i})] \cdot I_i^*(\tilde{\theta}_i, \theta_{-i}).\end{aligned} \tag{38}$$

It follows from (38) that each manager has *strong* incentives to induce $I_i^* = 1$ when $\theta_i \geq \theta_i^*(\theta_{-i})$, and $I_i^* = 0$ when $\theta_i < \theta_i^*(\theta_{-i})$. This proves the sufficiency part of Proposition 2.

To prove the necessity part, we note that manager i's performance measure in period t is given by:

$$\pi(\theta_i, \theta_{-i}) = [x_{it} \cdot \theta_i - z_{it}(\theta_i, \theta_{-i}) \cdot b_i] \cdot I_i(\theta_i, \theta_{-i}).$$

Using arguments parallel to the ones in the proof of Proposition 1, we can show that $z_{it}(\theta_i, \theta_{-i}) = \frac{x_{it}}{b_i} \cdot \theta_i^*(\theta_{-i})$ for any $\theta_i > \theta_i^*(\theta_{-i})$. By Lemma 1, there exists a unique depreciation schedule and a unique capital charge rate that implements the intertemporal cost allocation scheme:

$$z_i(\theta) = \left(\frac{x_{i1}}{b_i} \cdot \theta_i^*(\theta_{-i}),\ldots,\frac{x_{iT}}{b_i} \cdot \theta_i^*(\theta_{-i})\right).$$

As argued in the text, one solution is provided by the capital charge rate $\hat{r} = r^*(\theta)$ combined with the relative benefit depreciation rule and this must therefore be the unique solution.

Proof of Proposition 3

For a given profile of types other than division i, θ_{-i}, let $U_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i)$ denote type θ_i manager's utility payoff in period t when he reports $\tilde{\theta}_i$. Therefore, the manager's total utility payoffs are given by $U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i) \equiv \Sigma_{t=1}^{T} \gamma^t \cdot U_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i)$. Under the competitive hurdle rate mechanism:

$$U_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) = \alpha(\tilde{\theta}_i, \theta_{-i}) + \beta(\tilde{\theta}_i, \theta_{-i}) \cdot [a_{it} + I_i^*(\tilde{\theta}_i, \theta_{-i}) \cdot (x_{it} \cdot \theta_i - z_{it}(\tilde{\theta}_i, \theta_{-i}))] - v_{it}(a_{it}),$$

where $I_i^*(\cdot,\cdot)$ denotes the optimal investment decision rule and $z_{it}(\cdot,\cdot)$ denotes the sum of depreciation and interest charges, as defined in (6).

For each division, the central office chooses the compensation parameters $\{\alpha_{it}, \beta_{it}\}_{t=1}^{T}$ such that $\beta_{it}(\tilde{\theta}) = v_{it}'$ and $\alpha_{it}(\tilde{\theta}) = v_{it}(\bar{a}_{it}) - v_{it}' \cdot \bar{a}_{it}$ for any report profile $\tilde{\theta}$. This choice of bonus coefficients ensures that $a_{it} = \bar{a}_{it}$ for each i and t. Furthermore, the relative benefit depreciation schedule corresponding to the agency-adjusted competitive hurdle rate $r_i^{**}(\theta_{-i})$ implies that $z_{it}(\tilde{\theta}, \theta_{-i}) = x_{it} \cdot \theta_i^{**}(\theta_{-i})$. As a consequence, manager i's total utility payoff becomes:

$$U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i) = \kappa_i \cdot I_i^*(\tilde{\theta}_i, \theta_{-i}) \cdot [\theta_i - \theta_i^{**}(\theta_{-i})] \tag{39}$$

where $\kappa_i \equiv \Sigma_{t=1}^{T} \gamma^t \cdot v_{it}' \cdot x_{it}$.

It is clear from (39) that manager i's participation constraint holds for each θ_{-i}, and each manager has a strong dominant strategy incentive to report his information truthfully. Furthermore, a comparison with (19) reveals that manager i's interim utility payoffs $E_{\theta_{-i}}[U_i(\theta_i, \theta_{-i}|\theta_i)]$ from (39) coincide with those of the optimal revelation mechanism.

Proof of Corollary 4

For given κ_1 and κ_2, division i's cutoff profitability parameter $\theta_i^{**}(\theta_{-i}|\kappa_1, \kappa_2)$ is defined by the equation:

$$VNPV_i(\theta_i^{**}(\theta_{-i}|\kappa_1, \kappa_2)) = \max\{VNPV_j(\theta_j|\kappa_j), 0\}, \quad j \neq i.$$

Since the virtual NPV is given by $VNPV_i(\theta_i|\kappa_i) = NPV_i(\theta_i) - \kappa_i \cdot H_i(\theta_i)$, it follows that $VNPV_i(\theta_i|\kappa_i)$ is uniformly decreasing in κ_i. This immediately implies that $\theta_i^{**}(\theta_{-i}|\cdot)$ is uniformly increasing in κ_i and uniformly decreasing in κ_j, $j \neq i$. The result follows since the agency-adjusted competitive hurdle rate $r_i^{**}(\theta|\kappa_1, \kappa_2)$ is equal to $r_i^o(\theta_i^{**}(\theta_{-i}|\kappa_1, \kappa_2))$, and $r_i^o(\cdot)$ is an increasing function.

Proof of Proposition 4

Under the PMN mechanism, manager i's utility payoffs in period t are given by:

$$U_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i) = \alpha(\tilde{\theta}_i, \theta_{-i}) + \beta(\tilde{\theta}_i, \theta_{-i}) \cdot [a_{it} + I^*(\tilde{\theta}_i, \theta_{-i}) \cdot (x_{it} \cdot \theta_i - z_{it}(\tilde{\theta}_i, \theta_{-i}))] - v_{it}(a_{it}).$$

As in the proof of Proposition 3, high managerial efforts can be induced by setting $\beta_{it}(\tilde{\theta}) = v_{it}'$ for each report $\tilde{\theta}$. Combined with the PMN asset allocation rule $\{\lambda_i(\tilde{\theta}_i, \theta_i)\}_{i=1}^{N}$, relative benefit depreciation corresponding to the hurdle rate $r^{**}(\tilde{\theta}_i, \theta_{-i})$ ensures that $z_{it}(\tilde{\theta}_i, \theta_{-i}) = x_{it} \cdot \theta_i^{**}(\theta_{-i})$. When the fixed payments are chosen such that $\alpha_{it}(\tilde{\theta}) = v_{it}(\bar{a}_{it}) - v_{it}' \cdot \bar{a}_{it}$, manager i's total utility payoffs become:

$$U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i) = \kappa_i \cdot I^*(\tilde{\theta}_i, \theta_i) \cdot [\theta_i - \theta_i^{**}(\theta_{-i})]. \tag{40}$$

Clearly, the above PMN mechanism ensures that manager i's participation constraint holds for each θ_{-i}, and each manager has a strong dominant strategy incentive to report his information truthfully. Furthermore, each manager's interim utility payoffs $E_{\theta_{-i}}[U_i(\theta_i, \theta_{-i}|\theta_i)]$ from (40) coincide with those of the optimal revelation mechanism as given in (19).

Proof of Corollary 5

Since $\phi_i(\theta_i) = V_i(\theta_i) - \kappa_i \cdot H_i(\theta_i)$, Equation (29) implies that the cutoff-profitability parameter $\theta_i^{**}(\theta_{-i}|\kappa_1,\dots,\kappa_n)$ is uniformly increasing in κ_j for all $1 \leq j \leq n$. The result follows because:

$$r^{**}(\theta|\kappa_1,\dots,\kappa_n) = r^o(\theta_1^{**}(\theta_{-1}|\kappa_1,\dots,\kappa_n), \cdots, \theta_n^{**}(\theta_{-n}|\kappa_1,\dots,\kappa_n)),$$

and $r^o(\cdot)$ increases in each of its arguments.

APPENDIX B
DERIVATION OF RELAXED PROGRAM

The participation constraint $E_{\theta_{-i}}[U_i, \theta_i, \theta_{-i}|\theta_i)] \geq 0$ in the principal's original program **P** will hold with equality for the lowest type $\underline{\theta}_i$. This boundary condition combined with the fact that $a_{it}(\theta_i, \theta_{-i}|\theta_i) = c_{it}(\theta_i, \theta_{-i}) - x_{it} \cdot \theta_i \cdot I_i(\theta_i, \theta_{-i})$ and the "local" incentive compatibility condition implies that manager i will earn the following informational rents:

$$E_{\theta_{-i}}[U_i(\theta_i, \theta_{-i}|\theta_i)] = E_{\theta_{-i}}\left[\int_{\underline{\theta}_i}^{\theta_i} \sum_{t=1}^{T} \gamma^t \cdot v_{it}'(a_{it}(q_i, \theta_{-i}|q_i)) \cdot x_{it} \cdot I_i(q_i, \theta_{-i})\, dq_i\right]. \tag{41}$$

Integrating by parts yields that manager i's *expected* informational rents are given by:

$$E_\theta[U_i(\theta_i, \theta_{-i}|\theta_i)] = E_{\theta_{-i}}\left[\int_{\underline{\theta}_i}^{\bar{\theta}_i} \sum_{t=1}^{T} \gamma^t \cdot [v_{it}'(a_{it}(\theta)) \cdot x_{it} \cdot I_i(\theta) \cdot H_i(\theta_i)] f_i(\theta_i)\, d\theta_i\right], \tag{42}$$

where:

$$a_{it}(\theta) \equiv a_{it}(\theta_i, \theta_{-i}|\theta_i).$$

Since $U_i(\theta_i, \theta_{-i}|\theta_i) \equiv \Sigma_{t=1}^{T} \gamma^t \cdot [s_{it}(\theta_i, \theta_{-i}|\theta_i) - v_{it}(a_{it}(\theta))]$, substituting (42) into the objective function in **P** yields:

$$\max_{(a_i(\theta), I_i(\theta))_{i=1}^{n}} E_\theta\left[\sum_{i=1}^{n} \pi_i(\theta) - B(\theta)\right]$$

subject to (i_e), (i_s),

where:

$$\pi_i(\theta) \equiv \sum_{t=1}^{T} \gamma^t \cdot \{a_{it}(\theta) - v_{it}(a_{it}(\theta)) + x_{it} \cdot [\theta_i - v'_{it}(a_{it}(\theta)) \cdot H_i(\theta_i)] \cdot I_i(\theta)\}.$$

For any given investment rule $I_i(\theta)$, the central office will choose a_{it} to maximize:

$$a_{it} - v_{it}(a_{it}) - v'_{it}(a_{it}) \cdot x_{it} \cdot H_i(\theta_i) \cdot I_i(\theta)$$

Condition (20) implies that $1 - v'_{it}(\bar{a}_{it}) - v''_{it}(\bar{a}_{it}) \cdot x_{it} \cdot H_i(\theta_i) \cdot I(\theta) > 0$ for all θ_i and each $I_i(\theta) \in \{0, 1\}$. It is therefore optimal to induce the highest level of effort $\bar{a}_{it}$ for all θ_i. Consequently, the optimization program in **P** simplifies to the program in **P′**, and the optimal investment rules for the exclusive and shared asset settings are as given by (22) and (23), respectively.

To complete the proof, we need to show that the resulting scheme is globally incentive compatible. As shown in Mirrlees (1971), a mechanism is incentive compatible provided it is locally incentive compatible, and $\partial U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i)/\partial\theta_i$ is weakly increasing in $\tilde{\theta}_i$. For the above mechanism:

$$\frac{\partial U_i(\tilde{\theta}_i, \theta_{-i}|\theta_i)}{\partial \theta_i} = \sum_{t=1}^{T} \gamma^t \cdot v'_{it}(a_{it}(\tilde{\theta}_i, \theta_{-i}|\theta_i)) \cdot x_{it} \cdot I_i(\tilde{\theta}_i, \theta_{-i}),$$

which is increasing in $\tilde{\theta}_i$ since $v'_{it}(a_{it}(\cdot, \theta_{-i}|\theta_i))$ is increasing in $\tilde{\theta}_i$ and the optimal $I_i(\cdot, \theta_{-i})$ is an upper-tail investment policy in both settings.

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Segment Profitability and the Proprietary and Agency Costs of Disclosure

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ABSTRACT: We exploit the change in U.S. segment reporting rules (from SFAS No. 14 to SFAS No. 131) to examine two motives for managers to conceal segment profits: proprietary costs and agency costs. Managers face proprietary costs of segment disclosure if the revelation of a segment that earns high abnormal profits attracts more competition and, hence, reduces the abnormal profits. Managers face agency costs of segment disclosure if the revelation of a segment that earns low abnormal profits reveals unresolved agency problems and, hence, leads to heightened external monitoring. By comparing a hand-collected sample of restated SFAS No. 131 segments with historical SFAS No. 14 segments, we examine at the *segment level* whether managers' disclosure decisions are influenced by their proprietary and agency cost motives to conceal segment profits. Specifically, we test two hypotheses: (1) when the proprietary cost motive dominates, managers tend to withhold the segments with relatively high abnormal profits (hereafter, the proprietary cost motive hypothesis), and (2) when the agency cost motive dominates, managers tend to withhold the segments with relatively low abnormal profits (hereafter, the agency cost motive hypothesis). Our results are consistent with the agency cost motive hypothesis, whereas we find mixed evidence with regard to the proprietary cost motive hypothesis.

Keywords: *segment profitability; segment reporting; discretionary disclosure; proprietary costs; agency costs.*

Data Availability: *All data are available from public sources, except for the restated SFAS No. 131 segment data, which are proprietary.*

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I. INTRODUCTION

This paper investigates what motivates managers to conceal line-of-business (LOB) information via segment aggregation. Aggregation is a central issue in financial reporting and to some extent is determined by mandated standards. Where a mandated standard exists, however, considerable managerial discretion is often allowed in how the standard is applied. We argue that, with respect to the number of segments firms report, this was the case to a great extent under SFAS No. 14 and is so to a lesser extent under the current SFAS No. 131.[1] We therefore exploit the change to SFAS No. 131 segment reporting to examine two possible motives for discretionary nondisclosure (i.e., aggregation) of segments under SFAS No. 14, namely, proprietary costs and agency costs.

Our investigation of segment reporting contributes to the empirical literature on discretionary disclosure choices. Empirical tests of voluntary disclosure often aim to test the predictions of theoretical models. The traditional motive offered by the literature to explain nondisclosure in general (e.g., Verrecchia 1983) and aggregation of segments in particular (e.g., Hayes and Lundholm 1996) is that disclosure reveals proprietary information.[2] This motive is also the one most often put forward by managers. For instance, Ettredge et al. (2002) report that 86 percent of the industrial firms that commented on the Exposure Draft for SFAS No. 131 opposed the new standard on the grounds that "it would put them at competitive disadvantage." It is therefore not surprising that prior empirical studies focus primarily on examining the proprietary costs of segment disclosure (e.g., Harris 1998; Piotroski 2003; Botosan and Stanford 2005). These papers generally find evidence consistent with disclosure being constrained by proprietary costs.

We argue that much of the prior evidence consistent with the proprietary cost hypothesis is also consistent with an alternative "agency cost" hypothesis that posits disclosures are withheld as a result of conflicts of interest between managers and shareholders. Nevertheless, prior segment reporting papers do not attempt to directly test whether managerial self-interest plays a role in segment aggregation decisions. Even in the broader empirical disclosure literature, scant evidence exists on the agency cost motive for withholding disclosure.[3]

Segment reporting is potentially fertile ground for examining the impact of agency conflicts on disclosure decisions. Prior research provides evidence that multi-segment firms trade at a discount relative to stand-alone firms (the "diversification discount") and that internal capital markets in firms with diversified LOB transfer funds across segments in a suboptimal manner (e.g., Lang and Stulz 1994; Berger and Ofek 1995; Lamont 1997; Shin and Stulz 1998). Moreover, Berger and Hann (2003) find that firms that started reporting multiple segments (as opposed to one segment) when SFAS No. 131 came into effect experienced an increase in their diversification discount in the year of the disclosure change. If greater disclosure more fully reveals the extent of value-destruction at an underperforming firm, then the potential for corporate governance and control mechanisms to discipline the

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[1] SFAS No. 14 is FASB Statement No. 14, *Financial Reporting for Segments of a Business Enterprise* (FASB 1976). SFAS No. 131 is FASB Statement No. 131, *Disclosures about Segments of an Enterprise and Related Information* (FASB 1997).

[2] Theory also suggests that under reasonably broad circumstances greater disclosure can result in capital market benefits. Prior research finds evidence consistent with higher disclosure resulting in capital market benefits (see, e.g., Sengupta 1998; Hail and Leuz 2006). Nevertheless, the evidence that increased disclosure creates a capital market benefit remains controversial (see, e.g., Francis et al. 2006).

[3] One exception is Boehmer and Ljungqvist (2004), who find that German firms are less likely to go public when controlling shareholders enjoy large private benefits of control. Another exception is Leuz et al. (2006), who find evidence suggesting that Securities and Exchange Commission deregistrations are often motivated by the desire of controlling insiders to protect private control benefits and decrease outside scrutiny.

underperforming manager may increase. Consistent with this conjecture, Bens and Monahan (2004) find that within a 17-year U.S. panel, firms with more disclosure experience smaller diversification discounts. These findings together suggest that managers face potential costs from segment disclosures that reveal underperformance associated with agency problems. The primary purpose of this study is to provide evidence on this agency cost impact of disclosure.

In particular, we study managers' proprietary and agency cost motives to hide *abnormal segment profits,* which we define as a segment's rate of return relative to that of its industry. Given the limited set of items that are disclosed in segment footnotes, we argue that segment profitability is likely the most valuable piece of information managers might wish to withhold from competitors and investors. Managers face proprietary costs of segment disclosure if the revelation of a segment that earns high abnormal profits attracts more competition and, hence, reduces the segment's abnormal profits. On the other hand, managers face agency costs of segment disclosure if the revelation of a segment that earns low abnormal profits reveals unresolved agency problems and ultimately leads to heightened external monitoring. We therefore hypothesize that managers tend to withhold the segments with relatively high (low) abnormal segment profits when the proprietary (agency) cost motive dominates (hereafter, the proprietary (agency) cost motive hypothesis).

We test these two hypotheses using a sample of 796 firms (with 2,310 segments) that report multiple segments based on SFAS No. 131 restated segment reporting for the year prior to the adoption of SFAS No. 131 (hereafter, the lag adoption year). We hand-collect restated SFAS No. 131 data from lag adoption year 10-Ks to compare the segment information reported under the two reporting regimes for the same firm at the same point in time. The restated SFAS No. 131 and historical SFAS No. 14 segment data allow us to identify a set of "new" and "old" SFAS No. 131 segments and, hence, examine managers' reporting choice at the segment level. The new segments consist of those that were previously aggregated under the old regime, presumably because of the relatively greater discretion afforded under SFAS No. 14 and the desire to obscure the performance of the individual segments, whereas the old segments consist of those that were already reported as separate LOB segments under the old standard. The proprietary (agency) cost motive hypothesis therefore predicts that *within* the sample of firms in which the proprietary (agency) cost motive dominates, the new segments tend to have higher (lower) abnormal profits than the old segments.

Because the proprietary and agency cost motive hypotheses have opposite predictions about the new and old segments' abnormal profits, we partition our sample into two samples such that one cost consideration is likely to dominate the other and we test each hypothesis separately *within* each sample. Throughout the study, we refer to the set of firms for which the agency cost motive is likely to dominate as the "AC motive sample" and to the set for which the proprietary cost motive is likely to dominate as the "PC motive sample." Then, using a logit regression analysis, we test whether the new segments tend to have higher (lower) abnormal segment profits than the old segments *within* the AC (PC) motive sample.

Our results are consistent with the agency cost hypothesis. Within the AC motive sample, the new segments are associated with lower abnormal profits than the old segments, suggesting that managers avoid revealing poorly performing segment information when agency costs are the primary motive. We do not find evidence consistent with the proprietary cost hypothesis. Finally, we perform various sensitivity tests to ensure that our inferences are not affected by measurement error in our abnormal segment profit measures. Our inferences are robust to these sensitivity tests.

Our results make two main contributions to the literature. First, the hand-collected restated SFAS No. 131 segment data allow us to study managers' reporting decisions at the segment level using segment profitability, which is conceptually a more relevant measure of the proprietary or agency costs of segment disclosure than the measures used in prior studies. Specifically, we argue that it is how well a segment performs relative to its industry that managers try to hide. Previous papers assume instead that segment aggregation aims to hide the profitability of the industry that the segment operates in. We view such an assumption as unrealistic because industry-wide information is likely already available to both competitors and the market. Put differently, in studying managers' motives to withhold segment data, one needs to consider not only what managers want to hide, but also what they *can* hide. If the information is already available to competitors and the market, then there is no proprietary or agency cost of disclosing such information. Conceptually, neither industry profits (Harris 1998; Botosan and Stanford 2005) nor firm-level profits (Piotroski 2003) serve to capture the underlying proprietary costs of segment disclosure as they are likely already known by competitors. Therefore, segment profitability is a more relevant measure than those used in prior studies.

Second, prior research (e.g., Harris 1998; Ettredge et al. 2002; Piotroski 2003) focuses on examining the proprietary costs of segment disclosure. We extend the segment disclosure literature as well as the broader discretionary disclosure literature by incorporating the agency costs of disclosure in our analysis. Moreover, because the proprietary and agency cost motives to withhold segment information yield opposite predictions for the hidden segments' abnormal profits, our analysis highlights the importance of partitioning the sample by differing motives.

The rest of the paper is organized as follows. Section II reviews the related literature and presents our research hypotheses. Section III details our sample selection and research design. Section IV provides our empirical results and sensitivity tests. Section V concludes.

II. RELATED LITERATURE AND RESEARCH HYPOTHESES

Several prior studies explore segment reporting as a discretionary disclosure choice. These studies generally find that segment reporting choices are influenced by proprietary costs. Harris (1998) examines the relation between competition and disclosure of industry segments and interprets her findings as evidence that operations in less competitive industries are less likely to be reported as industry segments. Botosan and Harris (2000) examine the determinants of managers' decisions to voluntarily increase segment disclosure frequency and do not find any association with proprietary costs. Botosan and Stanford (2005) interpret their results as evidence that, under SFAS No. 14, managers hide profitable segments operating in less competitive industries. Consistent with this line of research, our first hypothesis predicts that managers face proprietary cost motives to withhold segment data.

The primary purpose of our study is to shed light on a second motive to withhold segment data—namely, the agency cost motive. Recent studies provide evidence that managers may also face agency costs of segment disclosure, which arise when segment data provide information that is indicative of unresolved agency problems. In particular, Berger and Hann (2003) and Sanzhar (2003) examine the impact of more disaggregated segment disclosure under SFAS No. 131 and find that the more disaggregated reporting under SFAS No. 131 creates a greater diversification discount. These findings are suggestive of managers concealing information about agency problems under SFAS No. 14, although they are also consistent with firms being forced by SFAS No. 131 to reveal additional proprietary information.[4]

Segment data are of particular importance for revealing agency concerns because they provide information about a company's diversification strategy and its transfers of resources across divisions. Prior research finds evidence consistent with internal capital markets in conglomerates transferring funds across segments in a suboptimal manner (Berger and Ofek 1995; Lamont 1997; Shin and Stulz 1998; Rajan et al. 2000). Several studies indicate that diversified firms trade at a discount relative to stand-alone firms (Lang and Stulz 1994; Berger and Ofek 1995) and that the diversification discount is associated with measures of agency problems (Denis et al. 1997; Berger and Ofek 1999).[5] Managers may therefore use their discretion opportunistically to conceal negative segment information. Accordingly, our second hypothesis predicts that managers face agency cost motives to withhold segment data.

We focus on managers' proprietary and agency cost motives to hide abnormal segment profits, which we define as the segment's rate of return relative to that of its industry. The reasons we focus on segment profitability are as follows. First, as noted before, managers' number-one stated concern about greater segment disclosure is competitive harm (Ettredge et al. 2002); managers are ultimately concerned that the loss of competitive advantage and increased competition from potential entrants would lead to lower abnormal profits. Second, in a typical segment footnote, there are five key line items: sales, assets, earnings, capital expenditures, and depreciation. Earnings (deflated by segment sales or assets) is probably the most relevant measure in assessing the segment's performance. Finally, Berger and Hann (2003) provide descriptive evidence that while LOB revenues are often available in the management discussion and analysis (MD&A) section of a company's 10-K, earnings figures are generally found only in segment disclosures.[6] Hence, hiding segment profits (as opposed to hiding segment revenues or industry profits) is likely the dominant motive for managers to aggregate segment information.

From the proprietary cost perspective, when a segment earns an abnormal profit relative to its industry peers, competitors may follow its business/marketing strategies or enter the specific product markets (within that industry) that the segment operates in. Hence, managers potentially have a proprietary cost motive to withhold segments with relatively high

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[4] The increase in the diversification discount following more disaggregated segment disclosure under SFAS No. 131 is more likely to be attributable to the revelation of agency problems than to proprietary costs for two reasons. First, given that publicly traded pure-play firms disclose more rather than less proprietary information relative to segments of publicly traded diversified firms, it is difficult to believe that proprietary costs are as likely as agency costs to be associated with the diversification discount. Second, as opposed to a voluntary increase in disclosure, a mandated increase is less likely to impose a net proprietary cost on a firm. With a mandated disclosure increase, a firm benefits from the enhanced disclosures of its competitors at the same time that it is harmed by its own disclosure increase.

[5] There is considerable debate, however, as to whether the diversification discount results from diversification per se as opposed to self-selection effects (whereby firms with poorer prospects are more likely to diversify and/or segments with poorer prospects are more likely to be acquired than to stand alone). The view that diversification accounts for the discount is usually linked to the view that, on average, diversified firms have greater unresolved agency conflicts than their pure-play peers. The position that self-selection can explain part or all of the discount sometimes attributes the self-selection mainly to efficiency motives (e.g., Campa and Kedia 2002) and sometimes ascribes the self-selection at least partly to agency problems that exist at the diversified firm prior to its diversifying acquisitions (e.g., Villalonga 2004).

[6] Berger and Hann (2003) examine 100 SFAS No. 14 single-segment firms in their sample that have the largest increases in the number of segments reported due to the adoption of SFAS No. 131. They find that of the 443 new segments reported by these firms, 209 (47 percent) are discussed in some manner in the lag adoption year's MD&A. Numerical information about revenues is provided for 180 of these segments, but earnings figures are given for only 12.

abnormal profits. This prediction is theoretically ambiguous, however, because some models of voluntary disclosure are consistent with disclosure increasing rather than decreasing when concerns about competitors are greater (see, e.g., Darrough and Stoughton 1990; Newman and Sansing 1993; Gigler 1994). From the agency cost perspective, the presence of a poorly performing segment may reflect underlying unresolved agency problems associated with excess diversification or inefficient cross-segment transfers. Separately reporting such a segment may result in heightened external scrutiny. Thus, managers have agency cost motives to withhold segments with relatively low abnormal profits. Because the proprietary and agency cost motives yield opposite predictions on the abnormal profits of withheld segments, it is important that we test these predictions *within* a sample of firms for which one cost consideration dominates the other. Hence, we formally state the proprietary and agency cost motive hypotheses as follows:

H1—Proprietary Cost (PC) Motive Hypothesis: When the proprietary cost motive dominates, managers reporting under SFAS No. 14 tend to withhold the segments with relatively *high* abnormal profits (i.e., *within* the sample of firms for which the proprietary cost motive dominates, the *newly* revealed SFAS No. 131 segments tend to have *higher* abnormal profits than the *old* SFAS No. 131 segments).

H2—Agency Cost (AC) Motive Hypothesis: When the agency cost motive dominates, managers reporting under SFAS No. 14 tend to withhold the segments with relatively *low* abnormal profits (i.e., *within* the sample of firms for which the agency cost motive dominates, the *newly* revealed SFAS No. 131 segments tend to have *lower* abnormal profits than the *old* SFAS No. 131 segments).

III. SAMPLE SELECTION, DATA, AND METHODOLOGY

Sample Selection and Data

Our initial sample includes firms listed on Compustat's Annual Industrial, Research, and Full Coverage files, the CRSP monthly returns file, and the I/B/E/S detail database with minimum sales of $20 million and industry segment data available on Compustat's industry segment file.[7] To isolate the effect of SFAS No. 131 from real changes (such as acquisitions and divestitures), we hand-collect restated segment data from a company's first SFAS No. 131 10-K. This allows us to directly compare the historical SFAS No. 14 and the restated SFAS No. 131 segment data for the fiscal year prior to the adoption year (i.e., the lag adoption year) under the old and the new reporting regimes (see Figure 1 for a timeline detailing the data collection). The sample selection procedures used in this study closely follow those reported in Berger and Hann (2003) (hereafter, BH). We therefore provide only a summary of our sample selection in this section.[8] Our final sample includes 2,310 SFAS No. 131 segments, comprising 796 firms that report as multi-segment firms under SFAS No. 131 in the lag adoption year. We include only SFAS No. 131 multi-segment firms in our sample because our research question pertains to managers' decisions to aggregate segment data, and this disclosure decision is moot for "true" single-segment firms.

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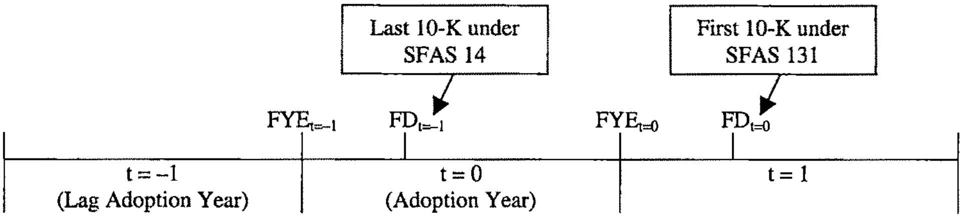
[7] While we do not use I/B/E/S data in this study, our initial sample imposes an I/B/E/S data restriction because the hand-collected restated data were constructed for another research project that requires analyst forecast data. Because the data collection costs on restated segment data are relatively high, we use the same initial sample in this study.

[8] See Berger and Hann (2003, Section IV) for a detailed discussion of the construction of the initial sample and the identification of SIC codes for the SFAS No. 131 segments.

FIGURE 1
Timeline for SFAS No. 131



Restated segment data for fiscal year -1 (the lag adoption year) based on SFAS No. 131: Hand-collected from first SFAS No. 131 10-K (released on $FD_{t=0}$).

Original segment data for fiscal year -1 (the lag adoption year) based on SFAS No. 14: Compustat segment data from the last SFAS No. 14 10-K (released on $FD_{t=-1}$).

The adoption year is the first year companies adopted SFAS No. 131. For most firms, the adoption year is 1998.

FYE = fiscal year-end;
FD = 10-K filing date.

We are interested only in the LOB segment-reporting choice for two reasons. First, a primary objective of SFAS No. 131 is to improve LOB segment disclosures by reducing the flexibility afforded under the industry approach. Second, prior research argues that it is LOB (and not geographic) diversification that is associated with agency problems. Our focus on LOB segment disclosure is also consistent with most prior studies of segment disclosure. To isolate LOB disclosures, we have to disentangle the geographic from the LOB segments. Under SFAS No. 14, industry LOB and geographic segment disclosures are separately reported and, hence, it is easy to identify LOB segments under the old regime. Under SFAS No. 131, while internal operating segments are most commonly defined based on the segment's LOB, they are sometimes defined based on geographic area. To ensure a fair comparison between the restated SFAS No. 131 segments and the historical SFAS No. 14 LOB segments and to avoid overstating the number of new LOB operating segments, we follow the same procedure described in BH to aggregate the operating segments that are defined based on geographic area.

Also, following the algorithm employed by BH, we eliminate all observations that are "contaminated," that is, for which the restated data partially reflect other changes at the firm in the adoption year (e.g., pooling acquisitions, discontinued operations, or changes from LIFO to other inventory accounting methods), to ensure that our restated segment data capture only reporting changes related to the adoption of SFAS No. 131. Further, we eliminate all firm observations for which the sum of segment sales deviates from firm-level sales by more than 5 percent.

To obtain our measure of abnormal (industry-adjusted) segment profit, we rely on the SIC codes assigned by Compustat to classify segments under both SFAS No. 14 and SFAS No. 131. The assignment of the SIC codes may seem more questionable under the new standard (segments are defined by the firm's internal operating system) than under the old standard (LOB segments were delineated along industry lines). We therefore conduct a validity test to check whether it is equally appropriate to use the SIC code classification of segments under both reporting regimes. Our results, discussed in detail in Appendix A, suggest that it is as appropriate to classify our SFAS No. 131 segments by the SIC code as it is for the SFAS No. 14 segments. Finally, all variables in our main analysis are winsorized at the 1st and 99th percentiles.

Methodology and Research Design

SFAS No. 131 Segments: New versus Old Segments

A major concern with SFAS No. 14 was that discretion with respect to a segment's industry definition allowed managers to report more aggregated segment information to external users than what was reported internally (Ernst & Young 1998). Prior studies (e.g., Street et al. 2000; Herrmann and Thomas 2000; Berger and Hann 2003) document a significant increase in the number of reported segments at the time of SFAS No. 131 adoption. One interpretation of this finding, and a maintained assumption of this study, is that the new standard offers relatively less discretion for segment aggregation.[9] This interpretation of the increase in reported segments under SFAS No. 131 suggests that managers used the discretion afforded under SFAS No. 14 to conceal segments that could have been separately reported. The mandated segment reporting change therefore allows us to study managers' disclosure decisions at the segment level by comparing the restated SFAS No. 131 segment data with the historical SFAS No. 14 data for the lag adoption year.

Specifically, we examine the restated SFAS No. 131 operating segments and classify each segment as either a new or an old segment. A restated SFAS No. 131 segment is classified as a new segment if it was not reported as a separate LOB segment under the old standard, and as an old segment if it was reported as a separate LOB segment in both the restated SFAS No. 131 and historical SFAS No. 14 segment disclosures.

To compare the restated SFAS No. 131 segments with the historical SFAS No. 14 segments, we first utilize the segment ID (SID) available from Compustat. Because our initial sample of SFAS No. 131 segments (with segment names, SIDs, and SIC codes) is obtained from Compustat in the adoption year, we can determine whether the SFAS No. 131 segments are new segments by matching the SFAS No. 131 SIDs to those of the SFAS No. 14 segments. If a match is found, then the segment is coded as an old segment; otherwise it is coded as a new segment (see Example 1 in Appendix B). We then manually examine all segments in our sample to identify any potential miscoding from Compustat. We focus on the matching of two items, namely, segment names and segment sales, in this second step. For any segment with identical segment names and sales under the two regimes, we code it as an old segment. In some cases, the segment names are identical under the two standards, but the restated sales figure is slightly different from the original SFAS No. 14 sales figure. There are also cases in which the restated and original segments have slightly different names (but share the same SIC code) and sales figures under the two regimes, but the information content is essentially the same across the two sources. In these two scenarios, we generally code the segment as an old segment (see Example 2 in Appendix B). For any firms that reported as a single-segment firm under SFAS No. 14 and became a multi-segment firm under SFAS No. 131, all SFAS No. 131 segments are by definition new segments.

Our approach is subject to caveats as a result of the following two maintained assumptions: (1) managers have relatively less discretion about the extent of segment aggregation under the new standard, and (2) the increased disclosure under the new standard reflects discretionary aggregation under the old standard. To the extent that these assumptions are not true, our segment classification—and, hence, our inferences—will be affected. With respect to the first assumption, we emphasize that our maintained assumption is that there is less discretion under SFAS No. 131 in one dimension of segment reporting—the number of reported segments. We recognize that the new standard still allows substantial

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[9] See Berger and Hann (2003) for a more detailed discussion of the main differences between SFAS No. 14 and SFAS No. 131.

discretion about some other aspects of segment reporting, such as the extent of allocation across segments. It is therefore possible that our results might be affected if managers strategically allocate expenses within each firm. For instance, if the AC (PC) motive to withhold segment information dominates, managers might have an incentive to allocate less (more) expenses to the segments with relatively low (high) abnormal profits. However, such strategic allocation would work against finding the hypothesized results.

Managers may also continue to have substantial discretion over reportable segments under SFAS No. 131 because firms can presumably restructure their "internal operating segments" to avoid reporting more disaggregated data. If the cost of internal restructuring is sufficiently low, then managers with incentives to conceal segment information will still be able to aggregate segment data under the new regime. In that case, either we would not find a significant increase in segment disclosure under the new standard, or the increased reporting would not fully reflect discretionary aggregation under the old standard. The reliance on our maintained assumptions is a limitation of our research design. We nevertheless view our maintained assumptions as reasonable and offer the following arguments to support them.

First, Street et al. (2000) find that very little internal restructuring occurs after SFAS No. 131. Specifically, only six of the 160 firms in their sample realign their organizational structure after SFAS No. 131. This result suggests that while it is feasible to reorganize internally to withhold segment information under the management approach, few companies appear to exploit this flexibility. Second, the new standard was largely the result of extensive lobbying by analysts (Association for Investment Management and Research [AIMR] 1993). From our conversations with the FASB project manager on the new standard, it appears that one of the main concerns of analysts was that "the old standard seemed to offer unlimited discretion," primarily because of the ample flexibility inherent in the definition of what an industry segment is.[10]

While the new standard does not completely preclude managers from discretionary aggregation, it is arguably subject to less discretion on segment aggregation compared to the old standard. Further, several studies (Street et al. 2000; Herrmann and Thomas 2000; Berger and Hann 2003) document that the number of reported segments under SFAS No. 131 increased significantly relative to SFAS No. 14. More importantly, the reporting change is overwhelmingly one-sided, with very few firms decreasing the number of reported segments. In other words, there was a significant increase in segment disaggregation when SFAS No. 131 was implemented. We acknowledge that the documented increase in segment reporting could merely indicate a neutral application of the old and the new standards. This would occur if the typical firm's internal segmentation for management decision purposes generally presents a finer partitioning than does an attempt to provide all relevant disaggregation under the industry approach. To the extent this is true, our inferences will be affected. However, if the reporting change reflects only managers' neutral compliance with the two reporting standards, then it should work against finding the hypothesized results.

Disentangling the Agency and Proprietary Cost Motives

As discussed previously, because the proprietary and agency cost motive hypotheses have opposite predictions about the new and old segments' abnormal profits, it is important

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[10] This quote is taken from an email correspondence with Ron Lott, one of the segment project managers at the FASB, who was involved with the SFAS No. 131 deliberations. Also, our conversations with audit partners from the Big 4 accounting firms suggest that it is generally very costly for companies to change their internal organization merely for purposes of affecting their external reporting. Overall, it appears that both analysts and auditors believe that the old standard afforded ample flexibility to aggregate segment data.

to partition our sample into two samples such that one motive is likely to dominate the other and then test each hypothesis separately *within* each sample. Accordingly, we split our sample into: (1) an agency cost (AC) motive sample (firms for which the AC motive likely dominates), and (2) a proprietary cost (PC) motive sample (firms for which the PC motive likely dominates). We partition the full sample as follows. First, we assume that absent agency problems managers act in the best interests of shareholders and would only choose to withhold segment information if the proprietary costs of disclosure outweighed the capital market benefits of disclosure. Thus, our PC motive sample includes all firms for which the agency cost motive to withhold segment profits is not present. In contrast, when the agency cost motive is present, managers do not act in the best interests of shareholders, so when the agency cost motive is present, we presume that it represents the dominant motive. Thus, our AC motive sample includes all firms for which the agency cost motive to withhold segment information is likely to be present.

Two clarifications regarding the partitioning into AC and PC motive samples are worth noting. First, the purpose of our study is *not* to compare segment profits across the PC and AC samples. In particular, we do *not* hypothesize and, hence, we do *not* test whether the segments in the PC sample have higher abnormal profits than those in the AC sample. Such a test would be tautological given our sample partitioning. Rather, the purpose of the sample partitioning is to test the PC and AC hypotheses *within* each sample by comparing segment profits across the *new* and the *old* segments.[11]

Second, our sample partitioning at the firm level is aimed at identifying a subset of *firms* (i.e., an AC motive sample) for which the agency cost motive is present and, hence, is likely to be the dominant motive. Not every *segment* in the AC motive sample has low abnormal profitability. If that were the case (i.e., if we constructed an AC sample such that all segments have low profitability), we would have relatively little variation in the variable being tested. Thus, our research design is aimed at testing whether the *new* segments tend to have lower abnormal profits than the *old* segments *within* the AC motive sample.

To identify a sample of firms for which the AC motive likely dominates, we rely on prior literature, which finds evidence of a diversification discount and suboptimal cross-segment transfers. Specifically, in the context of segment disclosure, we argue that managers of firms with inefficient cross-segment transfers likely face agency cost motives to withhold segment data. Our first step in constructing the AC motive sample is to use an approach similar to that of Billett and Mauer (2003) and Berger and Hann (2003) to construct a measure of transfers (*TRANSFER*) by comparing a segment's capital expenditures to its own cash flow. The intuition behind the construction of this measure is as follows. If a segment's free cash flow is not sufficient to cover its investments, then some investments are being subsidized by a combination of the following: other segments, excess operating cash flow of the segment in question in prior years, and the external capital market. Using the level of capital expenditures (CAPX) as a proxy for investment and the sum of operating profits and depreciation as a proxy for free cash flow, we first compute excess CAPX (i.e.,

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[11] Note that by construction the segments in the PC sample tend to have higher abnormal profits than the segments in the AC sample. Results from our within-sample analysis, however, are not mechanically driven by the way we partition our sample. Specifically, while the firms in the AC sample have at least one poorly performing segment by construction, this does not necessarily mean that the poorly performing segment is a new segment; it can very well be an old segment if the AC hypothesis does not hold.

max [CAPX − (operating profits + depreciation), 0]) for each segment.[12] All measures are constructed using restated SFAS No. 131 data for the lag adoption year. We then compare excess CAPX at the segment level with excess CAPX at the firm level to control for investments that are funded out of either prior years' retained cash flow or external financing. The difference between the segment's excess CAPX and the firm-level excess CAPX thus captures the extent of transfers from other segments.

Note that our measure of transfers does not indicate whether the shift of funds between segments is value-decreasing and, hence, attributable to agency problems. To incorporate into our measure an assessment of whether the cross-segment funds transmissions are inefficient, we follow Billett and Mauer (2003) and assume that a segment that underperforms relative to the remaining segments of the firm is an "inefficient" segment. Therefore, we classify a firm as having inefficient cross-segment transfers (i.e., the AC motive sample) if it has at least one segment that has both positive *TRANSFER* and a return on sales (ROS) that is less than the weighted average ROS of the remaining segments in the firm. All other firms are included in the PC motive sample.

Model of Managers' Segment Reporting Choice: PC versus AC Motives

We examine managers' segment reporting decisions by estimating various versions of the following logit regression at the segment level:

$$
\begin{aligned}
NEW = {} & \alpha + \beta_1 AC + \beta_2 I\_ROS * PC + \beta_3 I\_ROS * AC + \beta_4 HERF \\
& + \beta_5 PROFITADJ + \beta_6 I\_PE + \beta_7 I\_PERS + \beta_8 INDAGG + \beta_9 RELSIZE \\
& + \beta_{10} SEGDIVERSITY + \beta_{11} FSIZE + \beta_{12} MKTBK + \varepsilon. \qquad (1)
\end{aligned}
$$

The dependent variable, *NEW*, is a dichotomous variable that takes a value of 1 (0) if the segment is a new (old) SFAS No. 131 segment. The main variable of interest is *I_ROS*, our measure of abnormal profits, which we define and discuss in detail in the following subsection. Note that we do not include *I_ROS* as a separate independent variable in the pooled regression model because we test the PC and AC motive hypotheses separately *within* the AC and PC motive samples. Specifically, recall that the PC (AC) motive hypothesis predicts that the new segments tend to have higher (lower) abnormal profits than the old segments *within* the PC (AC) motive sample. In other words, the PC and AC motive hypotheses have opposite predictions on the association between *NEW* and *I_ROS*—the PC motive hypothesis predicts a positive association, and the AC motive hypothesis predicts a negative association.

One way to allow the relation between *NEW* and *I_ROS* to vary across the two conflicting motives is to estimate logit regressions separately for the PC and AC motive samples. Such an approach, however, would allow not only the coefficient of *I_ROS*, but also the coefficients of the other independent variables to vary across the two motives. Because we do not predict that the relation between *NEW* and the other independent variables would vary across the PC and AC samples, we opt for a second approach. We estimate a pooled regression with two interaction terms, *I_ROS * PC* and *I_ROS * AC*, which allows us to

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[12] Because we conduct our empirical analysis using two profit definitions, namely, earnings before interest and taxes (EBIT) or pre-tax income (PTI), the definition of operating profits is correspondingly either EBIT or PTI. See the subsection "Abnormal Segment Profits" for a more detailed discussion. Also, to maximize the number of usable observations, we assign depreciation a value of zero when it is missing. Finally, for a small number of firms, the segment CAPX is missing, but the firm-level CAPX is equal to zero (not missing). In these cases, we assign the segment CAPX a value of zero.

test the relation between *NEW* and *I_ROS* separately *within* each sample. The AC (PC) indicator takes a value of 1 if the segment is in the AC (PC) motive sample, and 0 otherwise. The PC motive hypothesis predicts a positive coefficient on the first interaction term, *I_ROS* * *PC* (i.e., $\beta_2 > 0$). The AC motive hypothesis predicts a negative coefficient on the second interaction term, *I_ROS* * *AC* (i.e., $\beta_3 < 0$).

In the following subsections, we define and discuss the construction of the abnormal segment profit measures and the control variables. All independent variables are constructed using restated SFAS No. 131 segment data for the lag adoption year.

Abnormal Segment Profits

We use industry-adjusted return on sales (*I_ROS*) as our primary measure of abnormal segment profits. An issue with using segment profitability ratios arises from the allocation of total sales and total assets to each segment. Sales are usually completely allocated among the reported segments of multi-segment firms, whereas assets are not. The magnitude of these unallocated assets is sufficiently large that it can distort inferences. For example, Berger and Ofek (1995) report that segments appear to have a somewhat smaller median book value of assets than stand-alone firms due solely to the incomplete allocation of assets to segments by multi-segment firms. Because sales are much more likely than assets to be fully allocated to a firm's segments, we use industry-adjusted ROS instead of ROA. Moreover, we eliminate all firms for which the sum of segment sales deviates from the firm-level figure by more than 5 percent. In our final sample, 99 percent of the segments have a deviation of less than 1 percent.

We recognize that industry-adjusted ROS captures segment profit margins rather than total segment profitability (i.e., it ignores asset turnover). By industry-adjusting, however, we reduce the likelihood of our ROS measure having a low correlation with ROA because the negative correlation between total asset turnover and ROS is smaller within industries than across industries. We confirm that the intra-industry correlation between ROS and ROA is relatively high, finding in untabulated tests that the mean (median) correlation between them for the stand-alone firms in our sample industries is 0.58 (0.59). Nevertheless, the sensitivity tests near the end of the paper include a test that replaces industry-adjusted ROS with industry-adjusted ROA as our measure of abnormal segment profitability.

I_ROS is measured at the segment level and the industry adjustment is based on the segment's primary SIC code, where an industry is defined based on the narrowest SIC grouping that includes at least five firms. While our research design allows us to study managers' reporting decisions at the segment level, we are faced with the limitation of a profit measure that is subject to measurement error because SFAS No. 131 does not prescribe a specific segment profit definition—it allows any (GAAP or non-GAAP) measure used internally for decision making to be reported as the segment profit. As a result, firms do not always use the same definition of segment profits, which complicates profit comparisons across firms.

To investigate the extent of this problem in our sample, we manually examine segment footnotes in an attempt to explore the feasibility of identifying a sample within which the segment profit definition is consistent. Identifying the segment profit definition, however, proves to be difficult because some firms do not clearly state their profit definition in their segment footnotes. For instance, some companies use generic terms like "segment profits" or "operating income," which mean different things at different firms. For these companies, we can only identify the profit definition used at the segment level if the firm provides a reconciliation of the sum of its segment profits to a specific firm-level income definition (e.g., pre-tax income or net income). Therefore, in addition to reading segment footnotes, we compare the sum of segment profits to various definitions of profit at the firm level (which we obtain from Compustat) and we label the difference between the two as the "profit deviation." We find that most firms use one of only a few formal profit definitions. However, the items that are allocated or not allocated to the segments (e.g., depreciation expense, amortization expense, SG&A, interest expense, interest income, special items, etc.) are quite diverse, which results in a multitude of effective profit definitions used in our sample. To address this problem, we first provide some descriptive statistics on the reported segment profit definitions for our sample. We then discuss the mechanism we use to adjust the reported segment profits to allow for a fair comparison across firms.

Table 1 reports descriptive statistics on the segment profit definitions for our sample firms. The reported definitions are either taken directly from the segment footnote from the adoption year 10-K or derived indirectly by comparing the sum of segment profits to total firm profits. We use the latter method to identify the segment profit definition only when a definition results in the difference between the sum of segment profits and total firm profits being equal to zero. We classify each firm into one of the following six profit definitions: (1) EBIT: earnings before interest and taxes, (2) PTI: pre-tax income, (3) EBITDA: earnings before interest, taxes, depreciation, and amortization, (4) IBEI: income before extraordinary items, (5) NI: net income, and (6) GP: gross profit. For the firms for which we cannot identify the segment profit definition (8 percent), we classify them in an "Other" category.

We note that there are still some variations within the six profit definitions because certain items such as special charges are sometimes included or excluded within each definition. The most widely reported definition is EBIT (58 percent), followed by PTI (18 percent). The other definitions are relatively sparsely employed.[13] The distribution of profit definitions at the segment level, reported in the far right column, is essentially the same as that at the firm level. While most firms (87 percent) report only one segment profit definition, 11 percent of the sample report two definitions, and less than 2 percent report more than two definitions. For firms with more than one segment profit definition, we code the firm's profit definition as the first of the definitions it uses from the following ordered set (in order of frequency used): EBIT, PTI, EBITDA, IBEI, NI, and GP. In other words, each firm is assigned only one profit definition.

Given that EBIT and PTI are the most widely used profit definitions at the segment level, we conduct our empirical analysis with both measures to ensure that our results are robust to using either definition. More importantly, to achieve comparability across firms, we create two corresponding "adjusted" segment profit measures by grossing the reported segment profits up or down by a portion of the deviation between the sum of segment profits and firm-level EBIT or PTI. The portion of the total profit deviation allocated to a segment is equal to the ratio of the segment's sales to the sum of segment sales. We refer to the deviation between the sum of segment profits and firm-level profits as the "profit deviation." Our measures of abnormal segment profits, $I\_ROS\_EBIT_{Adjusted}$ and $I\_ROS\_PTI_{Adjusted}$, are calculated using the corresponding "adjusted" segment profits.

Panel B of Table 1 presents the Pearson correlations between the two sets of industry-adjusted segment profits, one calculated using the reported segment profits and the other using the adjusted segment profits. The correlations between the reported and adjusted *I_ROS* for both EBIT and PTI are quite high, ranging from 0.96 to 0.99, which suggests that the cross-sectional variation in segment profits is driven primarily by "core" operating earnings (i.e., the part of earnings that is unaffected by the set of items such as depreciation

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[13] The distribution of profit definitions is comparable to that reported by Botosan and Stanford (2005).

TABLE 1
Descriptive Statistics on Segment Profits

Panel A: Distribution of Segment Profit Definitions for the Full Sample

	Firm-Level	Segment-Level
Segment Profit Definitions:		
EBIT: Earnings before interest and taxes	58%	58%
PTI: Pre-tax income	18%	18%
EBITDA: Earnings before interest, taxes, depreciation, and amortization	7%	7%
IBEI: Income before extraordinary items	4%	4%
NI: Net income	4%	4%
GP: Gross profits	1%	1%
Other	8%	8%
No. of observations	796	2,310
Percentage of firms with:		
One profit measure	87%	
Two profit measures	11%	
More than two profit measures	2%	

Panel B: Pearson Correlations between Reported and Adjusted Abnormal Segment Profits

	$I\_ROS\_EBIT_{REPORTED}$	$I\_ROS\_PTI_{REPORTED}$	$I\_ROS\_EBIT_{ADJUSTED}$	$I\_ROS\_PTI_{ADJUSTED}$
Full Sample (n = 2,321):				
$I\_ROS\_EBIT_{REPORTED}$	1.000			
$I\_ROS\_PTI_{REPORTED}$	0.989	1.000		
$I\_ROS\_EBIT_{ADJUSTED}$	0.976	0.966	1.000	
$I\_ROS\_PTI_{ADJUSTED}$	0.960	0.969	0.977	1.000

Panel A reports the distribution of segment profit definitions for the full sample, at both the firm and segment levels. The full sample includes 796 firms that report as multi-segment firms under SFAS No. 131 in the lag adoption year. See Figure 1 for the definition of lag adoption year. Certain items such as special charges are sometimes included or excluded within each of the first six profit definitions (i.e., EBIT, PTI, EBITDA, IBEI, NI, and GP); hence, there are some variations within each category. The "Other" category includes all observations for which we cannot identify the segment profit definition. For firms with more than one profit definition, we code the firm's profit definition as the first of the definitions it uses from the following ordered set (in order of frequency used): EBIT, PTI, EBITDA, IBEI, NI, and GP. Each firm is therefore assigned only one profit definition.

(*continued on next page*)

TABLE 1 (continued)

Panel B reports the Pearson correlations between the adjusted and reported abnormal segment profits for the full sample. The industry-adjusted return on sales (ROS) measures, calculated using either the reported or adjusted segment profits, are defined below:

$I\_ROS\_EBIT/PTI_{REPORTED}$ = industry-adjusted segment $ROS\_EBIT/PTI_{REPORTED}$, where $ROS\_EBIT/PTI_{REPORTED}$ is segment ROS calculated using $EBIT/PTI_{REPORTED}$ (i.e., the earnings number reported in the segment footnote that yields the smallest firm EBIT/PTI deviation); the EBIT/PTI deviation is the difference between the sum of segment profits and the firm-level EBIT/PTI; and

$I\_ROS\_EBIT/PTI_{ADJUSTED}$ = industry-adjusted segment $ROS\_EBIT/PTI_{ADJUSTED}$, where $ROS\_EBIT/PTI_{ADJUSTED}$ is segment ROS calculated using the adjusted segment profit measure, $EBIT/PTI_{ADJUSTED}$. $EBIT/PTI_{ADJSUTED}$ is computed by grossing $EBIT/PTI_{REPORTED}$ up or down by the firm EBIT/PTI deviation based on segment sales, where the EBIT/PTI deviation is defined as the difference between the sum of segment profits and the firm-level EBIT/PTI.

All segment-level measures are constructed using restated SFAS No. 131 segment data for the lag adoption year. Industry is defined as the narrowest SIC code with at least five firms for all industry-adjusted variables.

and amortization expense that may be allocated or unallocated at the segment level). Put differently, the cross-sectional variation in core operating earnings dominates the cross-sectional variation in the deviation.

While our measure of abnormal profits is subject to potential measurement error, it has several advantages over the profit measures used in prior studies. *I_ROS* is a direct measure of segment profits that captures how well a segment performs relative to its industry peers. Other measures of segment profitability such as the speed of profit adjustment used in Harris (1998), generally reflect industry profitability characteristics, which are not hidden. Publicly available industry information is likely of secondary importance in managers' reporting decisions compared with a direct measure of the segment's performance. Prior studies (e.g., Piotroski 2003; Botosan and Stanford 2005) have also used firm-level abnormal profits to capture potential proprietary costs. Firm-level profit measures have less measurement error because they are based on GAAP definitions and are not affected by within-firm allocations. On the other hand, it is segment profits rather than firm-level profits that managers may try to hide via aggregation. Our measure of segment profits is therefore a more relevant measure for studying discretionary disclosure, although this enhanced relevance carries with it the problem of potential measurement error.

Control Variables

Prior studies on segment disclosure (e.g., Harris 1998; Botosan and Stanford 2005) use measures of industry competition to proxy for proprietary costs of disclosure. We therefore include two widely used measures to control for industry competition: *HERF* and *PROFITADJ*. *HERF*, the Herfindahl index, is widely used as a measure of industry concentration and competition. We first compute the industry measure of *HERF* as follows:

$$\text{Industry Herfindahl index } (IHERF_j) = \sum_{i=1}^{n} [s_{ij}/S_j]^2,$$

where:

s_{ij} = business i's sales (segment i's sales for segments of multi-segment firms and firm i's sales for single-segment firms) in industry j, as defined by two-digit SIC code;
S_j = the sum of sales for all businesses (including segments of multi-segment firms) in industry j;
s_{ij}/S_j = business i's market share; and
n = the number of businesses in industry j.

The greater $IHERF_j$, the higher (lower) the current level of industry concentration (competition) for industry j. We then match the industry measure to each segment by two-digit SIC code to obtain an estimate of the segment's industry concentration ratio.

PROFITADJ is an industry abnormal profit adjustment measure constructed based on Harris (1998). It is intended to capture the speed with which abnormal profits are driven down to a normal rate of return. In particular, we estimate the persistence of abnormal profits for each industry using the following industry-pooled, cross-sectional, time-series regression over the 1985 to 1997 period:

$$X_{ijt} = \beta_{0j} + \beta_{1j} (D_n X_{ijt-1}) + \beta_{2j} (D_p X_{ijt-1}) + \varepsilon_{ijt},$$

where:

X_{ijt} = the year t difference between firm i's ROA and the mean ROA for its two-digit industry, j;
D_n = an indicator variable that takes the value of 1 if X_{ijt-1} is less than or equal to 0, and 0 otherwise; and
D_p = an indicator variable that takes the value of 1 if X_{ijt-1} is greater than 0, and 0 otherwise.

The coefficient estimate of D_pX_{ijt-1} (i.e., β_{2j}) is used to measure the speed of adjustment for positive abnormal ROA in industry j, with greater β_{2j} indicating a slower rate of abnormal profit adjustment. We then assign the industry measure to each segment by two-digit SIC code to obtain the industry abnormal profit adjustment rate applicable to each segment.

To ensure that *PROFITADJ* is not merely capturing each segment's industry earnings persistence, we include an additional control variable, *I_PERS*, which measures the segment's earnings persistence. *I_PERS* is constructed in a similar manner to *PROFITADJ*. We first estimate the following industry-pooled, cross-sectional, time-series regression over the 1985 to 1997 period:

$$X_{ijt} = \beta_{0j} + \beta_{1j}X_{ijt-1} + \varepsilon_{ijt},$$

where:

X_{ijt} = year t difference between firm i's ROA and the mean ROA for its two-digit industry, j.

The coefficient estimate of lagged ROA (β_{1j}) is a measure of the persistence of abnormal earnings within industry j. We then match the industry measure to each segment by two-digit SIC code to obtain an estimate of the segment's persistence of abnormal earnings.

In addition, we control for another important segment attribute that may affect managers' reporting decisions, namely, growth opportunities. Piotroski (2003) finds that firms with higher growth opportunities are associated with lower reporting fineness at the firm level, suggesting that growth opportunities may capture proprietary costs of segment disclosure. We therefore include *I_PE*, a measure of segment growth opportunities, as a control variable. Because price-earnings (PE) ratios are not available at the segment level, we use the median PE ratio of the industry in which a segment operates as a proxy for the segment's PE ratio. Specifically, *I_PE* is computed based on the narrowest SIC grouping that includes at least five firms.

We include five additional control variables in the model: the level of pre-SFAS No. 131 industry aggregation (*INDAGG*), the segment's size relative to the firm (*RELSIZE*), segment diversity (*SEGDIVERSITY*), firm size (*FSIZE*), and firm growth opportunities (*MKTBK*). *INDAGG* captures the degree of industry aggregation prior to SFAS No. 131. Multi-segment firms may be more likely to aggregate their segment data to hide profit information if their segments operate in industries in which a large portion of their multi-segment peers are also aggregating. To construct the measure of pre-SFAS No. 131 industry aggregation, we first compute the proportion of sales from single-segment firms to total industry sales before and after SFAS No. 131 (i.e., in 1997 and 1998), where we define an industry by two-digit SIC code. The time-series of this measure of single-segment industry share (*PUREPLAY*) is of interest. In particular, we find in unreported analysis that *PUREPLAY* is relatively stable in the periods before and after SFAS No. 131. In the three years prior to SFAS No. 131 (i.e., 1995–1997), the average (median) *PUREPLAY* across all industries ranges between 45–47 percent (43–45 percent). In 1998, after the enactment of SFAS No. 131, the average (median) *PUREPLAY* decreases to 32 percent (26 percent) and stays at about that level in the two years thereafter. The significant drop in *PUREPLAY* in 1998 is consistent with a large number of pre-SFAS No. 131 single-segment firms switching to multiple-segment reporting after SFAS No. 131 (as documented in prior studies). Put differently, the industries with the biggest drop in *PUREPLAY* after SFAS No. 131 are industries with a larger proportion of multi-segment firms that were aggregating (reporting as single-segment firms) under SFAS No. 14. We therefore use the magnitude of the decrease in *PUREPLAY* in 1998 as a measure of pre-SFAS No. 131 industry aggregation (i.e., $INDAGG = PUREPLAY_{97} - PUREPLAY_{98}$). After computing *INDAGG* for each industry, we match it to each segment by two-digit SIC code to obtain a measure of the pre-SFAS No. 131 extent of aggregation in the segment's industry.

The next two control variables, *RELSIZE* and *SEGDIVERSITY*, capture the firm's ability to report aggregated segment information under the old reporting rule. *RELSIZE* is the ratio of segment sales to firm sales. If the main goal of segment aggregation is to hide information about abnormal profitability, aggregating small segments with larger ones will make it difficult to infer the abnormal profitability of the small segment. *SEGDIVERSITY* is a measure of diversity. Under SFAS No. 14, firms with operations in similar industries were afforded greater discretion to aggregate segment information than those with operations in diverse industries. We measure segment diversity as the ratio of the number of unique two-digit SIC codes across segments to the total number of restated SFAS No. 131 segments. Finally, we control for firm size and for growth opportunities, as proxied by the market-to-book ratio.

Profit Deviation: 10 Percent, 5 Percent, and 2 Percent Deviation Samples

Because companies report different profit definitions at the segment level under SFAS No. 131, we adjust the reported (restated) segment profits by grossing them up or down by their share of the profit deviation (i.e., the deviation between the sum of segment profits and firm-level profits). Each segment's share of the profit deviation is equal to the ratio of the segment's sales to the sum of segment sales for all the firm's segments. While the profit adjustment provides a uniform profit definition across the sample, it can introduce measurement error in the abnormal segment profit measures, especially when the profit deviation is large. We therefore conduct the logistic regression analyses on three samples: 10 percent, 5 percent, and 2 percent deviation samples. The 5 percent deviation sample, for instance, includes the firms for which the absolute profit deviation is less than 5 percent of the sum of segment sales. The 10 percent and 2 percent deviation samples are constructed analogously. The trade-off between using a higher cutoff versus a lower cutoff is the extent of the measurement error versus the sample size. With the 10 percent sample, we retain a large portion of the full sample (87 percent), but the measurement error on segment profits at some firms can be quite large. On the other hand, with the 2 percent sample, the average deviation is relatively small, but the sample size is substantially smaller (33 percent of the full sample). The 5 percent sample is probably the best sample for the purpose of our analysis. With the 5 percent sample, we are able to retain much of the original sample (67 percent of the full sample) and the extent of profit deviation is still within a reasonable range. Given these trade-offs, however, we report regression results from all three samples in Section IV.

Table 2 provides descriptive statistics on the magnitude of profit adjustment for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples, alternately using EBIT and PTI. Specifically, we define a profit adjustment as the absolute value of the difference between the adjusted and reported segment profits, deflated by segment sales. For the full sample, the profit deviation appears to be economically significant for at least a subset of the sample—the average EBIT (PTI) profit adjustment is 3.9 percent (4.9 percent). When we turn to the 10 percent deviation sample, the average EBIT and PTI adjustments are both lower by about 2 percent, and only one-quarter of the sample's EBIT (PTI) adjustments are above 2.4 percent (4.0 percent). As expected, the profit deviation becomes even smaller for the 5 percent and 2 percent deviation samples, especially for the 2 percent deviation sample. The profit adjustment and, hence, any potential measurement error arising from the adjustment, is unlikely to be economically significant in these samples.

IV. EMPIRICAL RESULTS

Analysis of Managers' Segment Reporting Decisions: Agency and Proprietary Cost Hypotheses

Descriptive Statistics and Sample Distribution

Table 3 presents descriptive statistics on general firm characteristics for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples. The descriptive statistics

TABLE 2
Descriptive Statistics on Segment Profit Adjustment

(|Adjusted Segment Profits – Reported Segment Profits|, deflated by Segment Sales)

	Mean	Std. Dev.	25th Percentile	Median	75th Percentile
Full Sample (n = 2,310):					
Profit Adjustment: EBIT	0.039	0.215	0.003	0.012	0.033
Profit Adjustment: PTI	0.049	0.183	0.009	0.025	0.050
10% Deviation Sample (n = 2,020):					
Profit Adjustment: EBIT	0.017	0.021	0.002	0.011	0.024
Profit Adjustment: PTI	0.027	0.023	0.008	0.022	0.040
5% Deviation Sample (n = 1,552):					
Profit Adjustment: EBIT	0.011	0.012	0.001	0.008	0.017
Profit Adjustment: PTI	0.019	0.014	0.006	0.017	0.030
2% Deviation Sample (n = 770):					
Profit Adjustment: EBIT	0.005	0.005	0.000	0.004	0.009
Profit Adjustment: PTI	0.008	0.006	0.003	0.008	0.014

Table 2 provides descriptive statistics on the sample's segment profit deviations separately for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples for the lag adoption year. The full sample includes 2,310 restated SFAS No. 131 segments, comprising 796 firms that report as multi-segment firms under SFAS No. 131 in the lag adoption year. The 10 percent deviation sample excludes from the full sample any firms for which the absolute EBIT and PTI deviations are more than 10 percent of total segment sales. The 5 percent and 2 percent deviation samples are constructed similarly. Segment profit adjustment is defined as the absolute value of the difference between the adjusted segment earnings ($EBIT_{ADJUSTED}$ or $PTI_{ADJUSTED}$) and the reported segment earnings ($EBIT_{REPORTED}$ or $PTI_{REPORTED}$), deflated by segment sales. $EBIT_{ADJUSTED}$ ($PTI_{ADJUSTED}$) are computed by grossing $EBIT_{REPORTED}$ ($PTI_{REPORTED}$) up or down by the firm EBIT (PTI) deviation based on segment sales, where the EBIT (PTI) deviation is defined as the difference between the sum of segment profits and firm-level EBIT (PTI).

TABLE 3
Descriptive Statistics: General Firm Characteristics

Mean	All Firms	Firms with New Segment	Firms without New Segment	Dif. between New and Old	p-value
Full Sample:					
Total Assets	3,943.09	4,045.03	3,810.51	234.52	0.80
Total Sales	2,682.63	2,581.09	2,814.68	−233.59	0.64
Total Market Value of Equity	2,903.04	2,939.12	2,856.11	83.01	0.88
Market-to-Book	2.89	2.98	2.77	0.21	0.19
Return on Assets	0.05	0.05	0.05	0.00	0.99
Return on Sales	0.04	0.04	0.04	0.00	0.61
No. of firm observations	796	450 (57%)	346 (43%)		
10% Deviation Sample:					
Total Assets	3,868.71	3,990.03	3,719.30	270.73	0.79
Total Sales	2,855.17	2,747.55	2,987.70	−240.15	0.67
Total Market Value of Equity	2,973.58	2,970.90	2,976.89	−5.99	0.99
Market-to-Book	2.86	2.92	2.78	0.14	0.38
Return on Assets	0.05	0.05	0.05	0.00	0.49
Return on Sales	0.05	0.05	0.05	0.00	0.90
No. of firm observations	694	383 (55%)	311 (45%)		
5% Deviation Sample:					
Total Assets	3,495.94	3,541.21	3,441.17	100.04	0.92
Total Sales	3,000.12	2,786.06	3,259.11	−473.05	0.48
Total Market Value of Equity	2,995.91	2,873.92	3,143.49	−269.57	0.70
Market-to-Book	2.91	2.92	2.90	0.02	0.90
Return on Assets	0.06	0.06	0.06	0.00	0.81
Return on Sales	0.05	0.05	0.05	0.00	0.57
No. of firm observations	537	294 (55%)	243 (45%)		
2% Deviation Sample:					
Total Assets	2,935.68	2,474.58	3,500.08	−1,025.50	0.47
Total Sales	2,802.73	2,332.44	3,378.35	−1,045.91	0.31
Total Market Value of Equity	2,578.97	1,947.68	3,351.66	−1,403.98	0.16
Market-to-Book	2.92	2.93	2.90	0.03	0.92
Return on Assets	0.06	0.06	0.06	0.00	0.59
Return on Sales	0.05	0.04	0.05	0.00	0.72
No. of firm observations	278	153 (55%)	125 (45%)		

Table 3 reports descriptive statistics for general firm characteristics for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples separately for the firms with new segments and for the firms without any new segments. The full sample includes 796 firms that report as multi-segment firms under SFAS No. 131 in the lag adoption year. The "Firms with New Segment" sample includes all firms with at least one new segment. The "Firms without New Segment" sample includes all other firm observations. A (restated SFAS No. 131) segment is classified as a new segment if it was not reported as a separate line-of-business segment under SFAS No. 14 in the lag adoption year. A (restated SFAS No. 131) segment is classified as an old segment if it was reported as a separate line-of-business segment both in the restated SFAS No. 131 and historical SFAS No. 14 segment disclosures in the lag adoption year. The 10 percent deviation sample excludes from the full sample any firms for which the absolute EBIT and PTI deviations are more than 10 percent of total segment sales. The 5 percent and 2 percent deviation samples are constructed similarly. EBIT (PTI) deviation is defined as the difference between the sum of segment profits and the firm-level EBIT (PTI). All measures reported in Table 3 are averages calculated over the three years prior to the adoption year.

are presented separately for firms with at least one new segment, firms without any new segments, and for all firms. The differences in means across the two subgroups are also presented in a separate column. For the full sample and the three deviation samples, the distributions across the two subgroups are very similar—roughly 55 percent of the firms have at least one new segment and 45 percent have no new segments.

The descriptive statistics from Table 3 suggest that firms with at least one new segment are not significantly different from firms without any new segments in terms of firm size (as measured by total assets, total sales, and market capitalization), the market-to-book ratio, and operating performance (as measured by return on assets and return on sales). This observation holds within the full sample and the 10 percent, 5 percent, and 2 percent deviation samples.

We also compare these firm characteristics across the full sample and the three deviation samples. None of the profit deviation cutoffs appears to create a sample-selection bias. Casual observation suggests that the firms in the three deviation samples are comparable to those in the full sample for most attributes. Statistical tests (not tabulated) confirm this observation. While the 2 percent deviation sample appears to be smaller in size than the full sample, its average total assets, total sales, and market capitalization are not significantly different from those of the full sample. (This holds across the three columns: all firms, firms with new segments, and firms without new segments).

Panel A of Table 4 reports the distribution of new and old segments for the full sample and the three deviation samples. Of the 2,310 segments in the full sample, 50 percent are newly revealed under SFAS No. 131 and 50 percent are already reported under SFAS No. 14. Similarly, the new and old segments are relatively evenly distributed in the three deviation samples, suggesting that the profit deviation cutoff does not create a bias in the distribution of new and old segments.

Panel B of Table 4 provides the distribution of segments across the AC and PC motive samples, separately for the full sample and the three deviation samples. Because we perform all empirical analysis using two profit definitions, EBIT and PTI, we have two different AC/PC partitions, one corresponding to each of the two profit definitions. As with the distribution of new and old segments, the distribution of the AC/PC partitions is very similar across the full and the three deviation samples. We therefore focus our discussion on the full sample.

Recall that our measure of transfers (*TRANSFER*) is affected by the segment's operating cash flow (see Section III), which we approximate by adding back depreciation to either EBIT or PTI. The AC/PC partition therefore varies with the profit definition. In particular, a lower income number makes it more likely that a segment's CAPX will exceed the proxy for the segment's operating cash flow and, hence, that a larger portion of the segments will be classified into the AC motive sample. For instance, when we partition the sample based on EBIT, 37 percent (63 percent) of the full sample's segments are classified into the AC (PC) motive sample. When we use PTI, which is always less than or equal to EBIT, 44 percent (56 percent) of the full sample's segments are classified into the AC (PC) motive sample, yielding a slightly more even distribution across the two groups.

Univariate Analysis

Table 5 reports the results of the univariate analysis on managers' segment-reporting decisions for the three deviation samples. For both the univariate and multivariate analysis, the results for the full sample are qualitatively and statistically similar to those for the 10 percent deviation sample. We therefore do not report the full sample results. Recall that the AC (PC) motive hypothesis predicts that the *new* segments have lower (higher) abnormal

TABLE 4
Distribution of New and Old Segments and Segments across the Agency and Proprietary Cost Motive Samples

Panel A: The Distribution of New versus Old Segments

SFAS No. 131	New Segments	Old Segments	Total Number of SFAS No. 131 Segments
Full Sample	1157	1153	2310
	(50%)	(50%)	(100%)
10% Deviation Sample	983	1037	2020
	(49%)	(51%)	(100%)
5% Deviation Sample	749	803	1552
	(48%)	(52%)	(100%)
2% Deviation Sample	372	398	770
	(48%)	(52%)	(100%)

Panel B: Distribution of Segments across the Agency and Proprietary Cost Motive Samples

	AC Motive Sample	PC Motive Sample	Total Number of Obs.
Full Sample			
EBIT	849	1461	2310
	(37%)	(63%)	(100%)
PTI	1023	1287	2310
	(44%)	(56%)	(100%)
10% Deviation Sample			
EBIT	724	1296	2020
	(36%)	(64%)	(100%)
PTI	875	1145	2020
	(43%)	(57%)	(100%)
5% Deviation Sample			
EBIT	540	1012	1552
	(35%)	(65%)	(100%)
PTI	660	892	1552
	(43%)	(57%)	(100%)
2% Deviation Sample			
EBIT	260	510	770
	(34%)	(66%)	(100%)
PTI	308	462	770
	(40%)	(60%)	(100%)

Panel A reports the distribution of new and old segments at the segment level separately for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples. The full sample includes 2,310 restated SFAS No. 131 segments, comprising 796 firms that report as multi-segment firms under SFAS No. 131 in the lag adoption year. The 10 percent deviation sample excludes from the full sample any firms for which the absolute EBIT and PTI deviations are more than 10 percent of total segment sales. The 5 percent and 2 percent deviation samples are constructed similarly. The EBIT (PTI) deviation is defined as the difference between the sum of segment profits and the firm-level EBIT (PTI). A (restated SFAS No. 131) segment is classified as a new segment if it was not reported as a separate line-of-business segment under SFAS No. 14 in the lag adoption year. A (restated SFAS No. 131) segment is classified as an old segment if it was reported as a separate line-of-business segment both in the restated SFAS No. 131 and historical SFAS No. 14 segment disclosures in the lag adoption year.

Panel B reports the distribution of segments across the AC and PC motive samples for the full sample and the 10 percent, 5 percent, and 2 percent deviation samples. The AC motive sample includes all segments in firms with at least one "inefficient" segment that has positive *TRANSFER*, where *TRANSFER* is defined as follows (alternatively using EBIT or PTI as segment profits):

(*continued on next page*)

TABLE 4 (continued)

$$Max\left[\frac{Segment\ Excess\ CAPX - Firm\ level\ Excess\ CAPX}{Mtk\ Value\ of\ Equity}, 0\right] \times 100,$$

where:

Excess CAPX = *max [CAPX* − *(OPS* + *DEP), 0]*;
CAPX = capital expenditures;
OPS = operating profits (alternatively using EBIT or PTI); and
DEP = depreciation expense.

A segment is classified as inefficient if its ROS is less than the weighted average ROS of the remaining segments in the firm. The PC motive sample includes all other observations. All segment-level measures are constructed using restated SFAS No. 131 segment data for the lag adoption year.

segment profits than the *old* segments *within* the AC (PC) motive sample. Univariate results for the AC (PC) motive hypothesis are reported in the left (right) panel. Within each panel, we report the abnormal segment profits (alternatively defined using EBIT and PTI) for the new and old segments, along with their differences. We also report the number of observations and the sample distribution in the table. Overall, the sample segments are relatively evenly distributed across the new and old segments for both the AC and PC motive samples. This observation holds for all three deviation samples and for both profit definitions.

For the AC motive sample, the results are qualitatively and statistically similar across the three deviation samples and the two profit definitions. In all cases, the new segments earn significantly lower average abnormal profits than the old segments (ranging from 10 percent lower in the 10 percent deviation sample to 18 percent lower in the 2 percent deviation sample), consistent with managers aggregating the poorly performing segments when the agency cost motive dominates. For the PC motive sample, the results are weaker. While the new segments' abnormal profits are significantly higher than those of the old segments in the 10 percent deviation sample, the abnormal profit differences across the new and the old segments are not different from zero at $p < 0.10$ level in either the 5 percent or 2 percent deviation samples. Thus, at best, the results from the univariate analysis are weakly consistent with the PC motive hypothesis. Of course, the univariate analysis does not control for factors other than profitability that may affect segment aggregation. These additional variables are incorporated in the multivariate analysis that follows.

Multivariate Logit Regression Analysis

Panels A and B of Table 6 present the results from the multivariate logistic regression analysis (i.e., estimation of Equation (1)) using EBIT and PTI. The results for the three deviation samples are presented in the left, middle, and right portions of each panel. Within each deviation sample, the first two columns report the coefficient estimates and their p-values and the third column reports the corresponding change in probability. Because we include multiple firm observations in our regression analysis, the p-values are generated using robust (Huber-White) standard errors that correct for firm clustering. The probability change columns measure the change in the probability of the segment being new given a one-standard deviation change in the independent variable; it is calculated as the product of the variable's marginal effect and its standard deviation.[14] The main variables of interest

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[14] The marginal effects are equal to $\Lambda(\beta x)([1 - \Lambda(\beta x)]\beta_i$, where Λ is the logistic cumulative distribution and β_i is the coefficient estimate of x_i. The marginal effects are calculated at the means of the independent variables.

TABLE 5
Univariate Analysis on Managers' Segment Reporting Decisions and Abnormal Segment Profits: Agency Cost versus Proprietary Cost Motives

	AC Motive Sample				PC Motive Sample			
	New Segments	Old Segments	Difference	p-value	New Segments	Old Segments	Difference	p-value
10% Deviation Sample (n = 2030):								
$I\_ROS\_EBIT_{ADJUSTED}$	−0.12 (342) [47%]	−0.02 (382) [53%]	−0.10**	0.02	0.10 (641) [49%]	0.06 (655) [51%]	0.04**	0.01
	(724)				(1296)			
$I\_ROS\_PTI_{ADJUSTED}$	−0.07 (436) [50%]	0.03 (439) [50%]	−0.10***	0.00	0.11 (547) [48%]	0.05 (598) [52%]	0.05***	0.01
	(875)				(1145)			
5% Deviation Sample (n = 1561):								
$I\_ROS\_EBIT_{ADJUSTED}$	−0.11 (262) [48%]	−0.01 (278) [52%]	−0.10**	0.02	0.07 (487) [48%]	0.06 (525) [52%]	0.01	0.30
	(540)				(1012)			
$I\_ROS\_PTI_{ADJUSTED}$	−0.06 (337) [51%]	0.05 (323) [49%]	−0.11***	0.00	0.09 (412) [46%]	0.06 (480) [54%]	0.03	0.22
	(660)				(892)			
2% Deviation Sample (n = 776):								
$I\_ROS\_EBIT_{ADJUSTED}$	−0.21 (131) [50%]	−0.03 (129) [50%]	−0.18***	0.01	0.10 (241) [47%]	0.06 (269) [53%]	0.04	0.14
	(260)				(510)			
$I\_ROS\_PTI_{ADJUSTED}$	−0.13 (159) [51%]	0.05 (149) [49%]	−0.18**	0.01	0.11 (213) [46%]	0.07 (249) [54%]	0.04	0.14
	(308)				(462)			

*, **, *** Statistical significance at the 10 percent, 5 percent, and 1 percent levels (two-tailed test), respectively.

The 10 percent, 5 percent, and 2 percent deviation samples and the AC and PC motive samples are defined in Table 4. All abnormal segment profit measures are defined in Table 1.

TABLE 6
Multivariate Logit Regression Analysis on Managers' Segment Reporting Decisions and Abnormal Segment Profits: Agency Cost versus Proprietary Cost Motives

	10% Deviation Sample			5% Deviation Sample			2% Deviation Sample		
	Coefficient	p-value	Probability Change	Coefficient	p-value	Probability Change	Coefficient	p-value	Probability Change
Panel A: Definition of Segment Profits: Earnings Before Interests and Taxes (EBIT)									

$$NEW = \alpha + \beta_1 AC_{EBIT} + \beta_2 I\_ROS\_EBIT_{ADJUSTED} * PC_{EBIT} + \beta_3 I\_ROS\_EBIT_{ADJUSTED} * AC_{EBIT} + \beta_4 HERF + \beta_5 PROFITADJ + \beta_6 I\_PE + \beta_7 I\_PERS + \beta_8 INDAGG + \beta_9 RELSIZE + \beta_{10} SEGDIVERSITY + \beta_{11} FSIZE + \beta_{12} MKTBK + \varepsilon$$

	Coefficient	p-value	Probability Change	Coefficient	p-value	Probability Change	Coefficient	p-value	Probability Change
Intercept	2.13***	0.00		2.41***	0.00		2.25***	0.00	
AC_{EBIT}	−0.10	0.51	−0.01	−0.04	0.81	−0.01	0.07	0.77	0.01
$I\_ROS\_EBIT_{ADJUSTED} * PC_{EBIT}$	0.37	0.11	0.02	0.18	0.51	0.01	0.43	0.28	0.03
$I\_ROS\_EBIT_{ADJUSTED} * AC_{EBIT}$	−0.32**	0.03	−0.03	−0.44**	0.01	−0.03	−0.67***	0.01	−0.06
HERF	1.48	0.12	0.02	1.45	0.17	0.02	0.48	0.75	0.01
PROFITADJ	0.29***	0.00	0.05	0.23**	0.05	0.04	0.21	0.21	0.03
I_PE	0.01	0.23	0.02	0.02	0.14	0.03	0.02	0.18	0.03
I_PERS	−0.30	0.14	−0.03	−0.15	0.52	−0.01	−0.09	0.80	−0.01
INDAGG	0.69	0.13	0.03	0.72	0.17	0.03	0.78	0.29	0.03
RELSIZE	−0.33**	0.02	−0.02	−0.16	0.31	−0.01	−0.07	0.73	−0.01
SEGDIVERSITY	−2.30***	0.00	−0.14	−2.70***	0.00	−0.17	−2.58***	0.00	−0.17
FSIZE	−0.14***	0.00	−0.07	−0.16***	0.00	−0.08	−0.19***	0.00	−0.09
MKTBK	0.00	0.95	0.00	−0.02	0.68	−0.01	−0.01	0.89	0.00
No. of Observations:									
New Segments	983			749			372		
Old Segments	1,037			803			398		
Total	2,020			1,552			770		
Pseudo R^2	0.11			0.13			0.14		

(continued on next page)

TABLE 6 (continued)

Panel B: Definition of Segment Profits: Pre-Tax Income (PTI)

$$NEW = \alpha + \beta AC_{PTI} + \beta_2 I\_ROS\_PTI_{ADJUSTED} * PC_{PTI} + \beta_3 I\_ROS\_PTI_{ADJUSTED} * AC_{PTI} + \beta_4 HERF + \beta_5 PROFITADJ + \beta_6 I\_PE + \beta_7 I\_PERS + \beta_8 INDAGG + \beta_9 RELSIZE + \beta_{10} SEGDIVERSITY + \beta_{11} FSIZE + \beta_{12} MKTBK + \varepsilon$$

	10% Deviation Sample			5% Deviation Sample			2% Deviation Sample		
	Coefficient	**p-value**	**Probability Change**	**Coefficient**	**p-value**	**Probability Change**	**Coefficient**	**p-value**	**Probability Change**
Intercept	2.05***	0.00		2.30***	0.00		2.19***	0.00	
AC_{PTI}	0.10	0.51	0.01	0.22	0.20	0.03	0.28	0.24	0.03
$I\_ROS\_PTI_{ADJUSTED} * PC_{PTI}$	0.45**	0.01	0.03	0.30	0.25	0.02	0.62*	0.09	0.03
$I\_ROS\_PTI_{ADJUSTED} * AC_{PTI}$	−0.41***	0.01	−0.03	−0.49***	0.00	−0.04	−0.62**	0.01	−0.06
HERF	1.49	0.13	0.02	1.38	0.20	0.02	0.34	0.82	0.01
PROFITADJ	0.29***	0.00	0.05	0.23**	0.05	0.04	0.22	0.20	0.04
I_PE	0.01	0.21	0.02	0.02	0.13	0.03	0.02	0.17	0.04
I_PERS	−0.30	0.13	−0.03	−0.17	0.47	−0.01	−0.10	0.78	−0.01
INDAGG	0.67	0.14	0.02	0.69	0.19	0.03	0.73	0.32	0.03
RELSIZE	−0.30**	0.03	−0.02	−0.10	0.51	−0.01	−0.02	0.91	0.00
SEGDIVERSITY	−2.32***	0.00	−0.14	−2.72***	0.00	−0.17	−2.63***	0.00	−0.17
FSIZE	−0.14***	0.00	−0.07	−0.16***	0.00	−0.08	−0.19***	0.00	−0.09
MKTBK	0.01	0.85	0.00	−0.01	0.78	−0.01	0.00	0.95	0.00
No. of Observations:									
New Segments	983			749			372		
Old Segments	1,037			803			398		
Total	2,020			1,552			770		
Pseudo R^2	0.11			0.13			0.15		

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*, **, *** Statistical significance at the 10 percent, 5 percent, and 1 percent levels (two-tailed test), respectively. p-values are generated using robust (Huber-White) standard errors that correct for firm clustering.

Panels A and B report the regression results of the following logit model for the 10 percent, 5 percent, and 2 percent deviation samples (as defined in Table 4):

(*continued on next page*)

TABLE 6 (continued)

$$NEW = \alpha + \beta_1 AC_{EBIT/PTI} + \beta_2 I\_ROS\_EBIT/PTI + \beta_3 I\_ROS\_EBIT/PTI * AC_{EBIT/PTI} + \beta_4 HERF + \beta_5 PROFITADJ + \beta_6 I\_PE + \beta_7 I\_PERS$$
$$+ \beta_8 INDAGG + \beta_9 RELSIZE + \beta_{10} SEGDIVERSITY + \beta_{11} FSIZE + \beta_{12} MKTBK + \varepsilon.$$

The dependent variable, *NEW*, is an indicator variable with the value of 1 (0) if the segment is a new (an old) segment. A segment is classified as a new segment if it was not reported as a separate line-of-business segment under SFAS No. 14 in the lag adoption year. A segment is classified as an old segment if it was reported as a separate line-of-business segment both in the restated SFAS No. 131 and historical SFAS No. 14 segment disclosures in the lag adoption year.

Definitions of Independent Variables:

$AC_{EBIT/PTI}$ = an indicator variable that takes the value of 1 (0) if the segment is included in the AC (PC) motive sample; see Table 4 for the definition of AC and PC motive samples;
$I\_ROS\_EBIT_{ADJUSTED}$ = industry-adjusted segment $ROS\_EBIT_{ADJUSTED}$; $ROS\_EBIT_{ADJUSTED}$ is segment ROS calculated using the adjusted segment profit measure, $EBIT_{ADJUSTED}$; $EBIT_{ADJUSTED}$ is computed by allocating any deviation between the sum of segment profits and firm-level EBIT to each segment's $EBIT_{REPORTED}$ based on segment sales;
$I\_ROS\_PTI_{ADJUSTED}$ = industry-adjusted segment $ROS\_PTI_{ADJUSTED}$; $ROS\_PTI_{ADJUSTED}$ is segment ROS calculated using the adjusted segment profit measure, $PTI_{ADJUSTED}$; $PTI_{ADJSUTED}$ is computed by allocating any deviation between the sum of segment profits and firm-level PTI to each segment's $PTI_{REPORTED}$ based on segment sales;
HERF = the Herfindahl index of the segment's corresponding two-digit industry concentration;
PROFITADJ = an estimate of the speed of abnormal profit adjustment for the segment's corresponding industry, where industry is defined based on two-digit SIC code; the higher the *PROFITADJ*, the lower the speed of profit adjustment; see Section III for a detailed discussion of the construction of this variable;
I_PE = the P/E ratio of the segment's corresponding industry; industry is defined by the narrowest SIC code with at least five firms;
I_PERS = an estimate of earnings persistence for the segment's corresponding industry, where industry is defined based on two-digit SIC code; see Section III for a detailed discussion of the construction of this variable;
INDAGG = the level of pre-SFAS No. 131 industry aggregation for the segment's corresponding industry, where industry is defined based on two-digit SIC code; see Section III for a detailed discussion of the construction of this variable;
RELSIZE = the ratio of segment sales to firm sales;
SEGDIVERSITY = the ratio of the number of unique SIC codes across segments to the total number of restated SFAS No. 131 segments;
FSIZE = the average of the log of the firm's total assets over the three years prior to the adoption year; and
MKTBK = the average ratio of the firm's market value of equity to book value of equity over the three year prior to the adoption year.

All segment-level variables are constructed using restated SFAS No. 131 segment data for the lag adoption year. The "Probability Change" measures the change in the probability of the segment being a newly reported segment upon adoption of SFAS No. 131, given a standard deviation change in the independent variables (x_i). It is calculated as the product of the marginal effect and the standard deviation of x_i. The marginal effects are equal to $\Lambda(\beta x)([1 - (\beta x)]\beta_i$, where Λ is the logistic cumulative distribution and β_i is the coefficient estimate of x_i. The marginal effects are calculated at the means of the independent variables. The Pseudo R^2 is computed as: $1 - \exp[-2(\ln L_r - \ln L)/\text{no. of obs.}]$, where L_r and L are the log-likelihood functions evaluated at the restricted (slopes = 0) and unrestricted estimates, respectively.

are the interaction terms between *I_ROS* and the AC and PC indicator variables. The AC motive hypothesis predicts a negative coefficient on *I_ROS * AC*, whereas the PC motive hypothesis predicts a positive coefficient on *I_ROS * PC*.

Before we turn to the tests of the main hypotheses, the results for two of the control variables are worth noting. First, we find a positive and generally statistically significant coefficient estimate on *PROFITADJ*. The p-value on this coefficient estimate is never better than 0.20 in the 2 percent deviation sample, however, which might be a result of the substantial drop in sample size for this sample. The overall finding on *PROFITADJ*, consistent with Harris (1998), suggests that managers tend to withhold the segments that operate in industries in which the firms with above-average profitability maintain their profitability advantage longer. This finding is interpreted by Harris (1998) and Botosan and Stanford (2005) as being consistent with the proprietary cost hypothesis. The basis for this interpretation is the view that the industry is less competitive (and thus proprietary information is more valuable) if the top-performing firms in the industry have maintained their advantage longer.

However, this finding is subject to an alternative interpretation. In particular, the slow convergence of the top performers toward the industry mean performance can be driven by the weaker firms continuing to experience unresolved agency problems (as opposed to the top firms having a competitive advantage via withholding proprietary information). *Ex ante*, it is unclear which interpretation dominates. We therefore interpret the positive estimates on *PROFITADJ* in Table 6 as being consistent with the new segments having been aggregated under SFAS No. 14 for either agency cost or proprietary cost reasons.

Another control variable, *SEGDIVERSITY*, has coefficient estimates that are consistently significant at $p < 0.01$ in the predicted direction. This result suggests that the degree of segment diversity is an important factor that affects the firm's ability to aggregate under the old reporting standard. This finding is perhaps unsurprising, as we expect firms with operations in diverse industries to be less able to aggregate their segment information than firms with operations in similar industries under the old industry-based reporting regime.

Turning to our primary tests, results from the logistic regression analysis are consistent with the AC hypothesis. In particular, the coefficient on *I_ROS * AC* is negative and significant at $p < 0.05$ level in all three deviation samples using either profit definition. For instance, for the 5 percent (2 percent) deviation sample with PTI (results reported in Panel B), the coefficient on *I_ROS * AC* is −0.49 (−0.62) and it is significant at $p < 0.01$ ($p < 0.05$). The −0.04 (−0.06) reported under the probability change column indicates that a one-standard deviation decrease in abnormal profits would increase the probability of a segment being aggregated under the old reporting standard by 4 percent (6 percent) within the AC motive sample. In short, the results suggest that when the agency cost motive dominates, managers tend to withhold the segments that have poor abnormal profits, consistent with managers using their discretion opportunistically to conceal negative information under the old standard.

The results for the test of the PC hypothesis are less consistent. The coefficient on *I_ROS * PC* is positive in all cases, but it is not always statistically significant at $p < 0.10$. When segment profits are defined using EBIT, the p-values of the coefficient of *I_ROS * PC* ranges from 0.11 in the 10 percent deviation sample to 0.51 in the 5 percent deviation sample. When segment profits are defined using PTI, the results are stronger, with the p-values for *I_ROS * PC* ranging from 0.01 in the 10 percent deviation sample to 0.25 in the 5 percent deviation sample. Overall, we do not find robust results consistent with the PC motive hypothesis.

The weak results for the PC motive hypothesis may seem surprising given that prior studies interpret their results as evidence that proprietary costs are associated with less segment disaggregation (i.e., Harris 1998; Botosan and Stanford 2005). Harris's (1998) main finding is that *PROFITADJ* is positively associated with segment aggregation. As discussed above, this finding appears to be as consistent with our AC motive hypothesis for segment aggregation as it is with the PC motive hypothesis.

The two main inferences Botosan and Stanford (2005) (hereafter, BS) draw with regard to proprietary costs are that hidden segments operate in less competitive industries than the hiding firm's primary industry and that the hidden segments make the hiding firms (falsely) appear to be underperforming their competitors. While both inferences are consistent with the PC hypothesis, we discuss below why they are questionable.

BS conduct their competitive environment tests on a sample of change firms that report multiple segments under SFAS No. 131, but only one segment under SFAS No. 14. They find that the *median* difference between a change firm's industry concentration ratio and the weighted average of the concentration ratios of its segments' industries is significantly negative, but that the *mean* difference is insignificantly different from zero. Ignoring the insignificant mean difference in drawing their inference is one factor that brings into question BS's conclusion that segment disclosure is lower among less competitive industries. A more important concern is that, unlike their profitability analysis, BS's competitive environment analysis makes no attempt to benchmark the results for the change firm sample against control samples of firms that did not change their segment reporting upon adoption of SFAS No. 131. Thus, it is not clear whether even the median concentration ratio result documented for the change firms is different from what one would find for multi-segment firms that did not change their number of reported segments when adopting SFAS No. 131.

The inference from BS's profitability analysis that the hidden segments make the hiding firms (falsely) appear to be underperforming their competitors is questionable for several reasons. First, BS's tests do not directly measure the profitability of hidden segments. Instead, they make their inference indirectly by measuring "unexpected" profit for the change firms based on the difference between a change firm's reported profit and the profit of its industry. This procedure is valid only if the industry profit is an accurate proxy for the change firm's expected profit in the absence of any strategic reporting behavior. The industry profit is alternately measured by a matched firm (matched to the change firm based on three-digit SIC code and sales) or by a no-change comparison group consisting of firms that report only one segment both before and after SFAS No. 131.

Second, BS do not find consistent results across their empirical analyses. BS's inference that the hidden segments made the hiding firms falsely appear to be underperforming arises only from the analysis of medians using the matched firm comparison group. When basing expected profits on matched firms, BS find that the change firms' *median* unexpected profits are significantly negative when using the firm-based expected profits and insignificant when using the segment-based expected profits. BS interpret the difference between the firm-based and segment-based results as attributable to the firm-based proxy for expected profits being observable in real time, whereas the segment-based proxy uses restated segment data that would not have been observable in real time. Thus, the fact that the expected profit proxy is smaller using the segment-based estimate is attributed by BS to firms choosing, under SFAS No. 14, to hide segments from relatively profitable industries. BS do not explain, however, why they fail to obtain similar results from the analysis of means using the matched firm comparison group or from the analyses of means and medians using the no-change comparison group.

Third, any differences between the firm- and segment-based results may be due to differences in measurement error rather than to differences in what was observable in real time. The segment-based approach first calculates the expected profits of the segments of the change firm and then adds the segments' expected profits together to arrive at the change firm's expected profit. This creates a problem because, for some firms, the sum of segment sales is less than firm sales. BS only eliminate such firms from their sample when the deviation exceeds 10 percent. Because they do not assign the unallocated firm sales to the segments, the segment-based expected (unexpected) profit figure is systematically biased downward (upward). This bias works in the direction of the finding that BS use to make their inference.

Fourth, because only univariate profitability analysis is performed, the BS tests implicitly assume that profitability is the only factor that affects whether a segment is hidden under SFAS No. 14. As our paper shows, however, other factors such as segment size, segment diversity, and firm size also affect the probability of hiding a segment. Failing to include these additional variables in a multivariate analysis may affect the inferences that BS draw about the impact of profitability.[15]

To provide further assurance that the differences between our inferences and those of Harris (1998) and BS are likely attributable to differences in research design and measures of proprietary costs (as discussed above), we explore whether our weak proprietary cost results are driven by our sample partitioning. We note that the results on the PC hypothesis are generally stronger when we use PTI instead of EBIT. Such a difference could arise because of differing measurement error embedded in the alternatively defined abnormal profit measures, and/or different sample partitions. The latter difference arises because our measure of transfers is a function of the segment's operating profits. Recall that when we partition the sample based on EBIT, 37 percent (63 percent) of the full sample segments are classified in the AC (PC) motive sample. When we use PTI, 44 percent (56 percent) of the full sample segments are classified in the AC (PC) motive sample.

One possible explanation for the weaker EBIT results on the PC hypothesis is that using EBIT as a definition of operating profits might overstate free cash flow and, hence, understate excess CAPX, which consequently leads to misclassifying some observations as PC motive firms when they should be classified as AC motive firms. To shed light on this issue, we perform a logit regression analysis similar to those reported in Table 6, but using the PTI AC/PC motive partition in conjunction with using *I_ROS_EBIT* as the abnormal profit measure. Results (not tabulated) are significantly stronger for the PC motive hypothesis—the coefficients on *I_ROS_EBIT * PC* are positive and significant at $p < 0.05$ in all three deviation samples (the coefficient on *I_ROS_EBIT * AC* remains consistently negative and significant at $p < 0.05$ in all three deviation samples). These results are consistent with potential misclassification of AC motive firms in the PC motive sample driving the weak results on the PC hypothesis. Nevertheless, the PC results are not robust to some of the sensitivity tests discussed in the next subsection. We therefore interpret our results as being mixed with regard to the proprietary cost hypothesis.

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[15] Several other research design differences between BS's and our study may also yield different inferences. For instance, BS do not follow the procedures of Berger and Hann (2003) to ensure that the restated segment data capture only reporting changes related to the adoption of SFAS No. 131. Also, BS calculate the change firms' unexpected profits by taking the difference between the firms' reported and expected profits and scaling by their reported profits. This procedure suffers from yielding observations with negative (and small positive) denominators.

Sensitivity Tests

As discussed previously, a limitation of exploiting SFAS No. 131 data is that segment profits are not defined in a consistent manner across firms. We therefore perform a battery of analyses in the previous section and a sensitivity test in this section to demonstrate that measurement error resulting from differences in segment profit definitions across firms is not driving our results. In addition, we perform several sensitivity tests to ensure that our results are robust to using a firm-adjusted (as opposed to industry-adjusted) abnormal segment profit measure, an industry-adjusted ROA (as opposed to industry-adjusted ROS) abnormal segment profit measure, an alternative AC/PC sample partitioning scheme, and an alternative set of deviation samples constructed using earnings (as opposed to sales) as the scaling factor.

Randomly Adjusted Abnormal Segment Profits

To provide additional evidence that our inferences on the agency cost hypothesis are not affected by measurement error arising from the profit adjustment, we perform a sensitivity test on the 5 percent deviation sample using a "randomly adjusted" segment profit measure. Specifically, the randomly adjusted measure is computed by artificially adding a noise term, δ, to each segment's $ROS_{REPORTED}$, where δ is uniformly distributed over $[-0.05, 0.05]$ to account for the full range of possible profit deviations in the 5 percent deviation sample. We then compute industry-adjusted abnormal segment profits using this alterative adjusted segment profit measure. Results from the logit regression analysis using this alternative abnormal segment profit measure, reported in Table 7, are qualitatively and statistically similar to the original results (reported in Table 6) for the 5 percent deviation sample (for both EBIT and PTI). In particular, the coefficient on $I\_ROS * AC$ remains negative and significant at $p < 0.05$. This sensitivity test indicates that the earlier results consistent with the AC hypothesis are unlikely to be attributable to measurement error arising from the profit adjustment.

Alternative Measure of Abnormal Segment Profits: Firm-Adjusted Abnormal Segment Profits

In our empirical analysis, we use industry-adjusted ROS as a proxy for abnormal profits to test both the agency and proprietary cost hypotheses. Conceptually, an industry benchmark is relevant in the context of proprietary costs because it captures how well the segment performs relative to its industry peers. However, in the context of agency costs, industry-adjusted profits may not be the best measure of abnormal profits. For instance, a segment that underperforms relative to its industry may be the best-performing segment in the firm if the other segments also fall behind their industry peers. An alternative measure is a firm-adjusted measure that captures how well the segment performs relative to the firm's remaining segments. We conduct a sensitivity test using a measure of firm-adjusted ROS (F_ROS), which is calculated as the difference between the segment's ROS and the weighted average of the remaining segments' ROS. The industry- and firm-adjusted ROS measures are highly correlated, with the (untabulated) Pearson correlation coefficient between these measures being 0.83 for EBIT and 0.81 for PTI. Not surprisingly, the (untabulated) results are qualitatively and statistically similar to those reported in Table 6 in all samples, indicating that our inferences are robust to using this alternative measure of abnormal segment profitability.

TABLE 7
Multivariate Logit Regression Analysis on an Alternative Abnormal Segment Profit Measure with a Randomized Noise Term (5% Deviation Sample)

	Coefficient	p-value	Probability Change	Coefficient	p-value	Probability Change
Intercept	2.29***	0.00		2.27***	0.00	
AC_{EBIT}	0.29*	0.10	0.04			
AC_{PTI}				0.37**	0.04	0.05
$I\_ROS\_EBIT_{RAND5\%} * PC_{EBIT}$	0.08	0.78	0.00			
$I\_ROS\_EBIT_{RAND5\%} * AC_{EBIT}$	−0.33**	0.05	−0.03			
$I\_ROS\_PTI_{RAND5\%} * PC_{PTI}$				0.13	0.60	0.01
$I\_ROS\_PTI_{RAND5\%} * AC_{PTI}$				−0.41**	0.02	−0.03
HERF	1.35	0.22	0.02	1.28	0.25	0.02
PROFITADJ	0.24**	0.04	0.04	0.24**	0.04	0.04
I_PE	0.01	0.16	0.03	0.01	0.17	0.02
I_PERS	−0.18	0.44	−0.02	−0.19	0.42	−0.02
INDAGG	0.63	0.23	0.02	0.64	0.23	0.02
RELSIZE	−0.12	0.43	−0.01	−0.10	0.51	−0.01
SEGDIVERSITY	−2.70***	0.00	−0.17	−2.70***	0.00	−0.17
FSIZE	−0.16***	0.00	−0.08	−0.16***	0.00	−0.08
MKTBK	−0.01	0.88	0.00	−0.01	0.87	0.00
No. of Observations:						
New Segments	749			749		
Old Segments	803			803		
Total	1,552			1,552		
Pseudo R^2	0.13			0.13		

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*, **, *** Statistical significance at the 10 percent, 5 percent, and 1 percent levels (two-tailed test), respectively. p-values are generated using robust (Huber-White) standard errors that correct for firm clustering.

Table 7 reports the regression results of various versions of the following Logit model for the 5 percent deviation sample (as defined in Table 4):

$$NEW = \alpha + \beta_1 AC_{EBIT/PTI} + \beta_2 I\_ROS\_EBIT/PTI_{RAND5\%} + \beta_3 I\_ROS\_EBIT/PTI_{RAND5\%} * AC_{EBIT/PTI}$$
$$+ \beta_4 HERF + \beta_5 PROFITADJ + 3_6 I\_PE + \beta_7 I\_PERS + \beta_8 INDAGG$$
$$+ \beta_9 RELSIZE + \beta_{10} SEGDIVERSITY + \beta_{11} FSIZE + \beta_{12} MKTBK + \varepsilon.$$

The dependent variable, *NEW*, is an indicator variable that takes the value of 1 (0) if the segment is a new (an old) segment. A segment is classified as a new segment if it was not reported as a separate line-of-business segment under SFAS No. 14 in the lag adoption year. A segment is classified as an old segment if it was reported as a separate line-of-business segment both in the restated SFAS No. 131 and historical SFAS No. 14 segment disclosures in the lag adoption year. $I\_ROS\_EBIT/PTI_{RAND5\%}$ is industry-adjusted segment $ROS\_EBIT/PTI_{RAND5\%}$. $ROS\_EBIT/PTI_{RAND5\%}$ is computed by artificially adding a noise term, δ, to each segment's $ROS\_EBIT/PTI_{REPORTED}$, where δ is uniformly distributed over [−0.05, 0.05]. Industry is defined by the narrowest SIC code with at least five firms. The AC_{EBIT} and AC_{PTI} are indicator variables that take the value of 1 (0) if the segment is included in the AC (PC) motive sample. See Table 4 for the definition of AC and PC motive samples. All other independent variables are defined in Table 6. The "Probability Change" measures the change in the probability of the segment being a newly reported segment upon adoption of SFAS No. 131, given a standard deviation change in the independent variables (x_i). It is calculated as the product of the marginal effect and the standard deviation of x_i. The marginal effects are equal to $\Lambda(\beta x)([1 - \Lambda(\beta x)]\beta_i$, where Λ is the logistic cumulative distribution and β_i is the coefficient estimate of x_i. The marginal effects are calculated at the means of the independent variables. The Pseudo R^2 is computed as: $1 - \exp[-2(\ln L_r - \ln L)/\text{no. of obs.}]$, where L_r and L are the log-likelihood functions evaluated at the restricted (slopes = 0) and unrestricted estimates, respectively.

Alternative Measure of Abnormal Segment Profits: Industry-Adjusted ROA

We also conduct a sensitivity test using industry-adjusted ROA (instead of ROS) as a proxy for abnormal segment profits. To address the fact that firm assets are often not fully allocated to the firm's segments, we follow the approach adopted by Berger and Ofek (1995). First, we exclude all observations for which the sum of the segment assets deviates from the firm's total assets by more than 25 percent. For those observations for which the asset deviation is less than 25 percent, we allocate the deviation proportionately to each segment based on the ratio of the segment's assets to the sum of segment assets. We then construct 10 percent, 5 percent, and 2 percent asset-deflated deviation samples where the cutoff is calculated by deflating the profit deviation by the sum of segment assets. While the sample size is smaller in the asset-deflated deviation samples, the (untabulated) results for the main logit regressions are qualitatively similar to those reported in Table 6. In particular, the coefficient estimates of the AC interaction term are negative and significant at either $p < 0.10$ or $p < 0.05$, with two exceptions: the coefficient estimates become marginally insignificant in the 5 percent EBIT deviation sample ($p = 0.13$) and in the 2 percent PTI deviation sample ($p = 0.11$). The coefficient estimates of the PC interaction terms in all deviation samples (for both EBIT and PTI) are never significantly different from zero at $p < 0.10$.

Alternative AC/PC Motive Sample Partition

Recall that our sample partition includes all firms with at least one inefficient segment with positive *TRANSFER* in the AC motive sample; all other firms are included in the PC motive sample. This scheme imposes a relatively high threshold for the AC partition. In particular, while the firms in the AC motive sample likely have inefficient cross-segment transfers associated with unresolved agency problems and, hence, have an agency motive to withhold segment information, the firms in the PC motive sample may not be entirely free of the agency cost motive. As a sensitivity test, we relax the inefficient segment requirement and include all firms with at least one segment with positive *TRANSFER* in the AC motive sample. This alternative sample partition yields a relatively even distribution across the two samples. Results from the logit regression analysis based on this alternative sample partition (not tabulated) are qualitatively and statistically similar to those reported in Table 6.

Alternative Deviation Samples: Deflated by Earnings

Recall that the 10 percent, 5 percent, and 2 percent deviation samples are constructed by using the ratio of the profit deviation to the sum of segment sales as a cutoff. The advantage of using sales instead of earnings as a deflator is that it avoids having negative denominators. However, it might leave room for large profit deviations even in the 5 percent and 2 percent samples. In particular, the median deviation as a percentage of EBIT (PTI) ranges from 8 percent (17 percent) in the 5 percent sample to 4 percent (8 percent) in the 2 percent sample.

To provide some assurance that our inferences are not driven by the large error observations, we perform additional sensitivity tests on our main regression analysis. In particular, we perform the main logit regression analysis (Equation (1)) on three earnings-deflated (as opposed to sales-deflated) deviation samples: 10 percent, 5 percent, and 2 percent. The 10 percent sample includes only firms for which: (1) the sum of segment profits is positive, and (2) the difference between the sum of segment profits and total firm profits is less than 10 percent of total segment earnings. The 5 percent and 2 percent samples are constructed similarly. As expected, the sample sizes for the earnings-deflated deviation samples are substantially smaller—each sample is roughly half as large as the corresponding sales-deflated deviation sample.

Note that while we construct the samples using earnings-deflated deviation thresholds (i.e., 10 percent, 5 percent, and 2 percent) to alleviate the large error concern, we continue to allocate the deviation based on segment sales (instead of segment profits) for two reasons. First, to properly and fully allocate the total deviation, we require not only a positive denominator but also a positive numerator for each segment. If we further exclude any firms that have one or more segments with negative profits (i.e., negative numerators), we would lose a prohibitively large portion of the sample. Second, the agency cost hypothesis tests whether the poorly performing segments are more likely to be hidden; excluding all the firms with negative earnings segments would yield a very low power test.

While the sample size of the three earnings deviation samples is substantially smaller, the results are generally qualitatively and statistically similar to those reported in Table 6. In particular, the (untabulated) coefficient estimates on the AC interaction term are negative and significant at $p < 0.10$ in both the PTI and EBIT regressions for all three deviation samples with one exception—the coefficient estimate is marginally insignificant ($p = 0.105$) in the EBIT regression for the 2 percent sample. The untabulated coefficient estimates on the PC interaction term are insignificant (positive and significant at $p < 0.10$) in the EBIT (PTI) regressions for all three deviation samples. Overall, our inferences are robust to using the earnings-deflated deviation samples.

V. CONCLUSION

This study examines whether managers' decisions to withhold segment information under SFAS No. 14 are influenced by their agency cost as well as proprietary cost motives to conceal segment profits. We hypothesize that when the proprietary (agency) cost motive dominates, managers tend to withhold the segments with relatively high (low) abnormal profits. We test these hypotheses by comparing a hand-collected sample of restated SFAS No. 131 segments with the historical SFAS No. 14 segments. The mandated change setting allows us to identify a set of "new" and "old" SFAS No. 131 segments and, hence, examine managers' reporting choices at the segment level. Our results are consistent with the agency cost hypothesis. In particular, we find that the new segments tend to have lower abnormal profits than the old segments when the agency cost motive dominates, suggesting that managers exploited the discretion afforded under SFAS No. 14 to opportunistically conceal negative information. Our results are mixed with regard to the proprietary cost hypothesis.

We believe the change from an industry approach to a management approach for segment reporting provides an excellent opportunity to study the motives behind the discretionary aggregation of segments under the industry approach. As part of its convergence project with the FASB, the International Accounting Standards Board (IASB) has issued an exposure draft that proposes changing its segment reporting standard from the current industry approach (similar to SFAS No. 14) to a management approach that would be very similar to SFAS No. 131. Such a change (currently scheduled to take effect in 2009) would allow for a rich extension of the approach in this paper to a broad set of countries with considerable variation in disclosure practices and, presumably, in the proprietary and agency costs of discretionary disclosure choices.

APPENDIX A

VALIDITY OF INDUSTRY CLASSIFICATION UNDER SFAS NO. 14 VERSUS SFAS NO. 131

To test whether it is equally appropriate to use the SIC code classification of segments under both reporting regimes, we conduct the following test. We first compute the correlations between the sales (earnings) of segments and the sales (earnings) of their corresponding industry, where industry is defined by the two-digit SIC code. Correlations for stand-alone firms are computed in a similar manner. We compute these correlations under both SFAS No. 14 and SFAS No. 131 (with geographic segments aggregated based on the mechanism described above), using a procedure similar to that in Givoly et al. (1999).

We include in each industry all businesses that are either stand-alone companies or segments of multi-segment firms. For each business, an industry index is formed by averaging (equally weighted and value-weighted by entity sales) the performance measure (i.e., sales or earnings) across all other entities in the industry. We then compute the time-series correlation of each business with its industry index, first based on the SFAS No. 14 segment definitions (pre-SFAS No. 131 period) and then using the SFAS No. 131 definitions (post-SFAS No. 131 period). We restrict both the pre-SFAS No. 131 and post-SFAS No. 131 analyses to firms with three consecutive years of observations. To assess the quality of the SIC code classification of segments, we compare the average of the correlations of the *segments* operating in an industry with those of the stand-alone firms, before and after SFAS No. 131. We denote these two sets of correlations as $Corr_{Segment}$ and $Corr_{Firm}$.

Although we are primarily interested in the segment correlations under SFAS No. 14 and SFAS No. 131, we use the correlations of the stand-alone firms as a benchmark to control for any potential time trend. For each performance measure, we report two sets of correlations—one with the equal-weighted industry index and the other with the value-weighted index. We believe that value-weighting is preferable, especially under SFAS No. 131. Under the new standard, there are more small segments and there is greater within-firm divergence in segment size.

The results, reported in Table A1, show that there is no difference between the two segment reporting regimes in the appropriateness of using SIC codes to classify segments. With the exception of the sales correlations constructed with the equal-weighted industry index, $Corr_{Segment}$ is insignificantly different under the two reporting regimes. Although the difference across the two standards in the equal-weighted sales version of $Corr_{Segment}$ is negative and significant (-0.193), the corresponding difference for the stand-alone firms (-0.201) is almost identical. Thus, the significant decline in this version of $Corr_{Segment}$ is unlikely to be driven by the new segment reporting standard.

These findings indicate that it is just as appropriate to classify our SFAS No. 131 segments by SIC code as it is for the SFAS No. 14 segments. We believe there are two reasons for this finding. First, *after* performing our aggregation of the SFAS No. 131 geographic operating segments, SFAS No. 131 data become more industry-oriented. Moreover, our findings (and prior complaints about SFAS No. 14 LOB reporting) are consistent with SFAS No. 14 being less reflective of industry information than it may have appeared to be.

TABLE A1
Correlation Coefficients between Segments/Stand-Alone Firms and Their Industries under SFAS No. 14 and SFAS No. 131

	Stand-Alone Firms ($Corr_{Firm}$)			**Segments ($Corr_{Segment}$)**			
Mean (t-statistics)	**SFAS No. 14**	**SFAS No. 131**	**Dif.**	**SFAS No. 14**	**SFAS No. 131**	**Dif.**	**Dif. of Dif.**
Sales:							
Equal-Weighted	0.478***	0.276***	−0.201***	0.369***	0.176***	−0.193***	0.009
	(15.16)	(4.60)	(−2.82)	(10.98)	(3.95)	(−3.47)	(0.14)
Value-Weighted	0.301***	0.220***	−0.082***	0.212***	0.176***	−0.036	0.045
	(5.77)	(3.36)	(−1.11)	(4.81)	(3.78)	(−0.65)	(0.73)
Earnings:							
Equal-Weighted	0.264***	0.252***	−0.012	0.148***	0.114***	−0.034	−0.022
	(7.98)	(4.71)	(−0.19)	(4.79)	(3.00)	(−0.67)	(−0.39)
Value-Weighted	0.180***	0.231***	0.051	0.133***	0.106***	−0.027	−0.078
	(4.47)	(4.06)	(0.79)	(4.81)	(3.08)	(−0.63)	(−1.28)

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*, **, *** Statistical significance at the 10 percent, 5 percent, and 1 percent levels, (two-tailed test), respectively.
The t-statistics are reported in parentheses.

In computing the industry indexes, we include in each industry all businesses that are either stand-alone companies or segments of multi-segment firms. For each business, an industry index is formed by averaging (equal-weighted or value-weighted by entity sales) the performance measure (i.e., sales or earnings) across all other entities in the industry.

$CORR_{Firm}$ = average correlation of sales (earnings) of stand-alone firms with their respective industries; and
$CORR_{Segment}$ = average correlation of sales (earnings) of segments (of multi-segment firms) with their respective industries.

APPENDIX B

We use the following two examples to illustrate our classification of new and old segments.

Example 1: American Home Products

For American Home Products, one of the four SFAS No. 131 segment SIDs is also reported in the original SFAS No. 14 data (Agricultural Products with SID = 8); we therefore code this segment as an old segment. The other three segments (SID = 9, 10, 11) are coded as new segments as they were aggregated into one segment, "Health Care Products," under SFAS No. 14.

SFAS No. 131 Segments	**SFAS No. 14 Segments**	**SID**	**Sales (131)**	**Sales (14)**	**New/Old**
	Health Care Products	7		12076.6	
Agricultural Products	Agricultural Products	8	2119.4	2119.4	Old
Consumer Health Care Pds		9	2091.3		New
All others		10	1316.2		New
Pharmaceuticals		11	8669.1		New

Example 2: ADAC Laboratories

ADAC Laboratories reports three segments under SFAS No. 14 and reports six segments under SFAS No. 131 for the lag adoption year. Note that while the segment names of the first two SFAS No. 131 segments are identical to those reported under SFAS No.

14, their sales figures are not the same. In this case, despite the difference in the sales figures (and the fact that Compustat coded these segments with different SIDs), we code the first two segments as old segments because we believe much of the information was already available in the original data. The last four SFAS No. 131 segments appear to have been aggregated previously under SFAS No. 14 as "Financial Services."

SFAS No. 131 Segments	**SFAS No. 14 Segments**	**SID**	**Sales (131)**	**Sales (14)**	**New/Old**
Electronic Payment Systems		14	115.012		Old
Direct Mail		17	249.682		Old
Paper Payment Systems		12	1287.367		New
Payment Protection Systems		13	190.559		New
Direct Response Marketing		15	49.781		New
Government Services		16	26.965		New
	Electronic Payment Systems	10		143.561	
	Direct Mail	11		232.542	
	Financial Services	9		1543.263	

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Management Control Systems in Early-Stage Startup Companies

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ABSTRACT: This paper uses a multi-method, multi-case field research design to study the evolving portfolio of the management control systems (MCSs) of 78 early-stage startup companies. We examine 46 individual systems from eight different MCS categories—financial planning, financial evaluation, human resource planning, human resource evaluation, strategic planning, product development, sales/marketing, and partnerships. We report analysis of the following: (1) The speed of adoption of financial planning and financial evaluation systems in relation to six other MCS categories. These systems are considered key MCSs associated with management accounting. We find financial planning to be the most widely adopted MCS category at an early stage, followed by the human resource planning and strategic planning categories. Financial evaluation systems are typically adopted at a later stage. (2) Variables associated with the rate of adoption of MCSs. Our results indicate that number of employees, presence of venture capital, international operations, and time to revenue are positively associated with the rate of adoption. Furthermore, the rate of adoption simultaneously affects company size. (3) CEO turnover and the rate of adoption of MCSs. We find that CEOs who have adopted fewer MCSs have shorter tenures. This is consistent with the hypothesized difference between entrepreneurs and managers. Overall, the evidence strongly supports the relevance of MCSs to the growth of early-stage startup companies.

Keywords: *management accounting; management control systems; entrepreneurship; growth companies; startup companies.*

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I. INTRODUCTION

Early-stage companies start with an open slate as regards management control systems (MCSs). This paper examines the evolving portfolio of MCSs in the following eight categories for 78 early-stage startup companies—financial planning, financial evaluation, human resource planning, human resource evaluation, strategic planning, product development, sales/marketing, and partnerships. We build on the findings in Davila and Foster (2005) that examined the speed of adoption of individual systems in two of these eight MCS categories—financial planning and financial evaluation. Each of the individual systems examined in Davila and Foster (2005) fall under what many view as the domain of management accounting, e.g., operating budgets and routine analysis of financial performance against targets. This extension paper examines 46 individual systems across the above eight MCS categories. An important finding is that financial planning and financial evaluation, both typically associated with management accounting categories, include individual systems that have well above-average early adoption by the 78 startup companies in our research. The voluntary early adoption of these individual management accounting-based systems indicate that these systems pass a market test as regards their "perceived value" compared to many other individual MCSs.

Management control systems—defined as "formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities" (Simons 1995, 5)—are important tools to professionalize a company. They are a subset of organizational routines (Nelson and Winter 1982; Zollo and Winter 2002) whose key characteristics include being recurrent, formalized, and information-based. MCSs help managers leverage their attention, liberate them from decisions that can be delegated and controlled by exception, and supply information when the informal network is overloaded.

The study of MCSs has mostly focused on cross-sectional variation in large established firms (Cardinal 2001; Chenhall 2003); it is only recently that empirical evidence on their emergence in early-stage startup firms is accumulating (Davila 2005; Davila and Foster 2005; Sandino 2007; Cardinal et al. 2004). These recent studies have examined factors associated with cross-sectional variation on the time-to-adoption of particular management control systems and how this timing varies with the strategy of startups. However, they only look at a subset of these systems and, more importantly, they address to a limited extent the issue of the relevance of MCSs to successfully deal with early-stage company growth.

We examine the evolution of 78 early-stage startup companies from their founding. Our research addresses three questions: (1) How fast do early-stage startup companies adopt financial planning and evaluation systems vis-à-vis other management control systems? (2) What variables are associated with the rate of adoption of these systems? (3) Does the rate of adoption of management control systems affect CEO rotation? We collect field research data using a multi-method, multi-case research design. The proprietary nature of the data and the detail needed to address the research questions demanded the design of tailored data collection instruments. For each company in our sample, we triangulate information from public sources, three questionnaires to three different managers, and three semi-structured interviews with each manager.

This paper contributes to the literature in four distinct ways. First, we provide detailed descriptive statistics on the adoption of 46 different MCSs. Second, we provide empirical evidence on the simultaneous association between the evolution of MCSs and company size, measured by the number of employees. This finding is consistent with the observation that company growth requires the management infrastructure that these systems provide, as well as the reverse that systems are a consequence of growth. Third, the entrepreneurship literature has documented an association between startup company growth and the replacement of the original CEO (Chandler and Jansen 1992; Willard et al. 1992). The proposed explanation for this empirical regularity is that the psychological characteristics of entrepreneurs are such that while they enjoy the fluidity of new ventures, they dislike the formality required for growth. We document an association between the level of MCSs' adoption and the likelihood of CEO turnover. CEOs who adopt fewer MCSs are replaced sooner; this is consistent with certain founders having difficulties in moving from an entrepreneurial to a managerial role—as measured by the level of adoption of a set of managerial tools—and being replaced.

II. MCSs' ADOPTION AND EARLY-STAGE COMPANY GROWTH

Three lines of research are relevant to this research. The first—applicable to the research question addressed in Section V on the impact of management control systems on startup company growth—examines the adoption of a subset of management control systems (MCSs) in startup companies. The second documents the frequent replacement of the founder as CEO in startup companies—informative to the research question in Section VI on the relevance of MCSs' adoption to CEO rotation. The third looks at the determinants of growth in startup companies.

MCSs Adoption and Company Growth

MCSs have been argued to facilitate growth (Simons 1995; Flamholtz and Randle 2000). They are adopted to overcome the limitations of informal management styles that require constant personal interaction. The need for these systems has been argued from agency and information-processing perspectives, which are the main roles of MCSs (Baiman 1982; Narayanan and Davila 1998). As companies grow, direct observation of the agents' effort—the main control approach in the absence of systems—becomes too costly and motivation and monitoring have to happen through the design of appropriate MCSs. Company growth also affects the ability to move information to the right decision makers. Without formal systems, the number of interactions required to move information around the company increases exponentially with the number of employees. Communication becomes too costly if MCSs are not implemented. These arguments propose the size of the company (in particular, number of employees) as a relevant variable in explaining the phenomenon.

The adoption of MCSs in startup companies is potentially an important stage in their growth. For the most part, the empirical findings on this question have focused on particular types of systems. Baron et al. (1996, 1999) examine the adoption of human resource (HR) management systems in startup firms. Their objective is to understand the impact of the founder's mental model of human resource relationships on the speed of adoption of these systems. Company size is significant in explaining speed of adoption in 17 out of 25 HR policies and in explaining the number of systems adopted at the end of the first year. Hellmann and Puri (2002) find that venture-backed firms are faster at adopting HR policies and stock-option compensation plans. Davila (2005) finds that size, CEO transition, and presence of venture capital are associated with the adoption of HR systems.

Moores and Yuen (2001) map the type of management accounting systems throughout the lifecycle of firms. In particular, they identify the transition from birth to growth as the point at which these systems are formalized. Granlund and Taipaleenmaki (2005) study management accounting systems in eight new economy firms. These authors provide some evidence on the sequencing of adoption of accounting systems. They find that budgeting is the first to be used; additional accounting systems are present only in firms with a strong belief about their future success. Davila and Foster (2005) examine the adoption of management accounting systems and of budgets in particular. They find that size, the presence of VC funding, CEO experience, and how the CEO interprets management accounting systems are associated with faster adoption of operating budgets. They also provide descriptive statistics on sequencing, and report that budgets are the first managerial accounting system adopted. They further find an association between the adoption of operating budgets and company growth. Sandino (2007) studies the adoption of an extended set of management accounting systems in a sample of 97 young U.S. retailers. She finds that almost all of these firms adopt a basic set of managerial accounting systems including budgets, pricing systems, and inventory control. But they differ in the adoption of more advanced systems; firms following a cost strategy add managerial tools focused on enhancing efficiencies; in contrast, firms following a differentiation strategy adopt tools to gather customer information. One case study (Cardinal et al. 2004) describes the evolution of control systems, interpreted to include informal as well as formal processes, in moving a company through its crucial early stages. This qualitative study is the first one that looks at a broad range of control mechanisms.

CEO Rotation and MCSs

A second research stream—summarized in the following quote, "[founders] are probably unsuited to be managers" (Greiner 1998, 61)—is relevant to this paper. The maintained assumption is that the founder "needs and values creative expression and is easily bored by familiar territory" (Rubenson and Gupta 1996, 25). However, evidence consistent with this assumption has barely started to emerge. Willard et al. (1992) do not find support for founders underperforming compared to non-founding CEOs. Fiet and Busenitz (1997) relate the likelihood of top management dismissal with sales underperformance, smaller boards, and the presence of venture capitalists on the board. Hellmann and Puri (2002) find that venture capitalists are faster at replacing the CEO with an outsider. Wasserman (2003) also finds that turnover of founders is associated with venture capital and with completing product development. This evidence reveals a pattern of founders' turnover, but does not address the maintained assumption that most entrepreneurs do not transition well to the managerial role that CEOs of larger firms have to fulfill.

High-Growth and Low-Growth Determinants

The third line of research relevant to this study focuses on explaining what differentiates high-growth from low-growth startups. Most of this research is based on empirical observation and has evolved around four main themes: management characteristics, competitive strategy, competitive environment, and funding.[1] For instance, Keeley and Roure (1990) identify the completeness of the founding team, technical superiority, product development time, and buyer concentration as associated with value creation in venture-backed startups. Feeser and Willard (1990) report that success is associated with top management's "sensitivity to opportunity." Similarly, Siegel et al. (1993) identify management's industry experience and its ability to stay focused as separating high-growth and low-growth young companies. Ciavarella et al. (2004) find that two (out of five) personality traits—conscientiousness and openness to experience—are associated with company survival.[2] Evidence on the potential role of MCSs is sparse but tends in the expected direction. Reid and Smith (2000) use a sample of 150 small and medium Scottish firms to examine variables associated with performance (measured as a combination of employee growth, profitability, and productivity). Their ordered logit specification (they group the firms into three performance groups) includes 20 variables capturing different aspects of the management team and organization. They find that management characteristics are nonsignificant or have a negative impact on performance except for "pursuit of high return on investment"; however "forward planning" and "organization and systems" have a positive effect. Barringer et al. (2005) content-analyze the narrative case studies for 50 high-growth and 50 slow-growth firms. Based on an extensive literature review, they base their analysis on four broad topics: founder characteristics, firm attributes (e.g., vision, planning, commitment to growth), business practices (e.g., product superiority, innovation), and HR practices. They conclude that high-growth companies: have founders with more experience, better education, and higher motivation; demonstrate stronger commitment to growth and alliances; show deeper customer understanding; and emphasize training, employee development, and financial incentives. Davila et al. (2003) report significant growth around venture capital funding events.

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[1] An emerging research thrust associated with startup growth focuses on valuation of these pre-IPO companies (Hand 2005; Armstrong et al. 2005).

[2] In this rich stream of research, see also Ibrahim and Goodwin (1986), Cooper et al. (1994); Herron and Robinson (1993), and Stuart and Abetti (1987).

III. COMPANY SAMPLE AND MCSs EXAMINED

The sampling process is described in Davila and Foster (2005), as well as the sample of 78 companies, including 48 information technology (IT) companies, 12 biotech companies, and 18 others. Prior to launching the research, we met five financial managers with experience in early growth companies (all of them with multiple company experience). After understanding the purpose of the research, these managers suggested companies of a size and age that would best fulfill the research needs. The sample selection required the companies to have between 50 and 150 employees at the sampling date, be less than 10 years old, and be independent. We adopted a multi-method, multi-case field research design. Information was collected from public sources such as company web pages and press releases from Lexis-Nexis. We also collected data using questionnaires filled out by three senior managers at each company—the CEO, CFO/financial manager, and the business development/marketing manager.

The questionnaire captured quantifiable information about the company including its financial and funding history as well as the dates in which particular MCSs were formalized. Semi-structured interviews were conducted with each of these three managers. Each interview relied on a detailed protocol to insure that the main topics were systematically covered during the conversation. The semi-structured nature of the interview gave flexibility to query the interviewer when clarification of particular practices was required (Marshall and Rossman 1995). Interviews, lasting about an hour with two researchers present, were taped and then transcribed. The interview was also instrumental in clarifying and triangulating the answers to the questionnaire (Jick 1979). Rich descriptions of each company's history gave a detailed context in which to understand why systems were adopted. During the interviews, we did not ask respondents directly about "intangible" variables such as company culture, which might vary depending on the respondent's background or bias regarding "acceptable practices." Rather, we inferred these variables from the interviewees' descriptions of their experiences (Seidman 1998).[3] Finally, we chose a multi-case field design to gather a large enough sample to go beyond company-specific experiences and examine whether the findings could be generalized through statistical validation.

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[3] The questionnaires and interview protocols are available from the authors.

The information was triangulated in various ways. Financial and funding information was compared with information independently collected by Venture One and Venture Economics.[4] The date of adoption of a subsample of MCSs was asked in two different questionnaires. In both of these triangulation efforts, the kappa statistic of inter-rater agreement was highly significant.

Table 1 provides descriptive statistics on the sample. CEO's have mean work experience of 18 years with the 25th percentile at 12 years. Most firms have not yet reached profitability, again reflecting the bias toward venture-capital based technology firms in the early years (see Armstrong et al. 2006). The mean number of rounds of venture capital financing is 3.43. Sixty of the 78 companies received financing from venture capitalists.

We asked respondents about the date of adoption of 46 individual systems from eight general categories of systems:[5] (1) Financial Planning (three individual systems); (2) Financial Evaluation (six systems); (3) Human Resource Planning (seven systems); (4) Human Resource Evaluation (four systems); (5) Strategic Planning (five systems); (6) Product Development Management (seven systems); (7) Sales/Marketing Management (ten systems); and (8) Partnership Management (four systems).[6] Founding date (date the company was legally established) was obtained from the CFO questionnaire and contrasted to the date reported in Venture One. In all cases but one, the dates were comparable; in this one case we contrasted the information with the CFO and used his reported date. The founding date was used to calculate the age of the company when each system was adopted. Management accounting systems fall into the first two categories:

TABLE 1
Descriptive Statistics on Sample of Companies

	Mean	Std. Dev.	Q1	Median	Q3
Number of CEOs	1.65	0.78	1	1	2
Years of Total Experience of CEO[a]	18.42	8.48	12	20	25
Age of the Company	5.47	2.44	3	5	7
Number of Employees[b]	118	62	71	113	155
Revenues ('000)[c]	10,923	11,853	2,437	7,300	15,000
Income ('000)[c]	−9,455	15,668	−12,469	−4,700	29
Number of VC Rounds	3.43	1.78	2	3	5
Valuation (millions)[d]	168.6	229.6	21.5	67.25	192.7

[a] Estimated for all CEOs in the sample.
[b] Number of employees is calculated at the peak of each company's size.
[c] Revenues and income are for the last year of data available.
[d] Valuation statistics are for the largest valuation round available.

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[4] Both firms are public data sources that collect funding information for startup companies. In some cases, they also report financial statement information.

[5] The systems were identified from various sources specific to each function, often from textbooks in the field. For instance, financial planning and evaluation were identified after examining several of the most popular managerial accounting textbooks (such as Horngren et al. 2006); human resource planning and evaluation were identified from the Baron et al. (1996, 1999) study on the HR models in startup firms. In addition, the list of systems was validated with the five managers we interviewed in the research planning stage.

[6] These systems are not intended to be an exhaustive list, but capture the main ones within each category. To further examine the adequacy of these eight groups we run an exploratory factor analysis with varimax rotation on the time-to-adoption of the 46 systems; the various systems loaded into factors that closely mapped into the categories defined.

- Financial Planning—operating budget; cash flow projections; sales projections
- Financial Evaluation—capital investment approval procedures; operating expenses approval procedures; routine analysis of financial performance against target; product profitability analysis; customer profitability analysis; customer acquisition cost analysis.

These two categories include nine of the 46 individual control systems examined in our research.

Interviews and questionnaires have certain limitations. There is no guarantee that the data fully reflects reality. Respondents may be subject to recall bias or to their image of the history of the company. We seek to mitigate this limitation by asking several respondents, asking about various dimensions of the variables of interest, and mainly inquiring about their experiences while minimizing their personal assessments. We also contrast their responses to publicly available sources of data when available.

IV. MCSs EVOLUTION FOR 46 INDIVIDUAL SYSTEMS AND EIGHT CATEGORIES

Table 2 reports the percentage adoption of each of the 46 individual systems by the end of Year 1 through Year 5. Figure 1 (Panel A) presents a summary of the 46 systems for the eight MCS categories. Each individual system within each category is equally weighted in Figure 1 and the average adoption of systems is computed for the end of Year 1 through Year 5. Several patterns are observable in Table 2 and Figure 1 (Panel A). First, Financial Planning systems (comprising operating budgets, cash flow projections, and sales projections) are consistently the most frequently adopted category across all eight MCS categories. Second, the three most widely adopted MCS categories in the early years since founding of a company all involve planning—financial planning, strategic planning, and human resource planning.[7] Third, the importance of the financial evaluation and human resource evaluation categories is lower than the three planning categories in the first three years, but increase in importance in Years 4 and 5. Fourth, the sales/marketing and partnership categories have lower adoption than other categories across each of the first five years since company founding.

Figure 1 (Panel A) plots the evolution of MCS categories by year since company founding for the 78 companies in our sample. These companies differ greatly in their increase (and decrease) in headcount over time. Figure 2 (Panel A) plots the evolution of MCS categories by headcount (less than 10 employees, less than 20 employees,...,less than 150 employees). There is a rapid buildup of systems, especially up to the 100-employees company size. The Financial Planning category has the highest percentage adoption at all company size levels examined in Figure 2 (Panel A).

Table 3 (Panel A) looks at the category mix of the ten most frequently adopted individual systems each year. The early dominance of planning systems (financial, HR, and strategy) is reinforced in this "top ten" systems analysis. In each of Years 1 to 3, systems from the three planning categories comprise at least 80 percent of the top ten systems. By Years 4 and 5, the mix of the top ten individual systems has broadened to include systems from both the Financial Evaluation category (capital investment approval procedures, operating expenses approval procedures, and routine analysis of financial performance against target) and the human resource evaluation category (written performance evaluation reports,

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[7] This finding is consistent with traditional control systems theory where planning comes first followed by evaluation and corrective actions (Ashby 1960; Anthony 1965).

TABLE 2

MCS Adoption Percentage by Year since Company Founding for 46 Individual Systems in Eight Categories: Full Sample of 78 Companies

Percentage of companies having adopted the system by the end of:		Year 1	Year 2	Year 3	Year 4	Year 5
Financial Planning	Operating budget	18%	41%	57%	72%	80%
	Cash flow projections	18	39	54	72	77
	Sales projections	14	32	49	68	74
Financial Evaluation	Capital investment approval procedures	13	28	43	59	77
	Operating expenses approval procedures	13	24	39	53	67
	Routine analysis of financial performance against target	10	27	43	53	67
	Product profitability analysis	4	14	20	21	30
	Customer profitability analysis	6	14	16	19	27
	Customer acquisition costs analysis	6	8	10	12	18
Human Resource Planning	Core values	22	31	40	53	59
	Mission statement	18	32	45	58	66
	Organizational chart	18	41	60	65	70
	Codes of conduct	15	26	31	39	47
	Written job descriptions	13	31	46	56	64
	Orientation program from new employees	13	25	43	55	58
	Company-wide newsletter	3	10	18	27	36
Human Resource Evaluation	Written performance objectives for managers	12	24	39	56	63
	Written performance evaluation reports	12	25	49	64	69
	Linking compensation to performance	12	22	45	56	66
	Individual incentive programs	7	13	31	41	52
Strategic Planning	Definition of strategic (nonfinancial) milestones	16	37	54	61	75
	Customer development plan (plan to develop market)	16	29	40	52	63
	Headcount/human capital development plan	16	32	42	53	58
	Product portfolio plan (plan about future products)	13	25	36	50	61
	Investment budget	10	31	42	50	53

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TABLE 2 (continued)

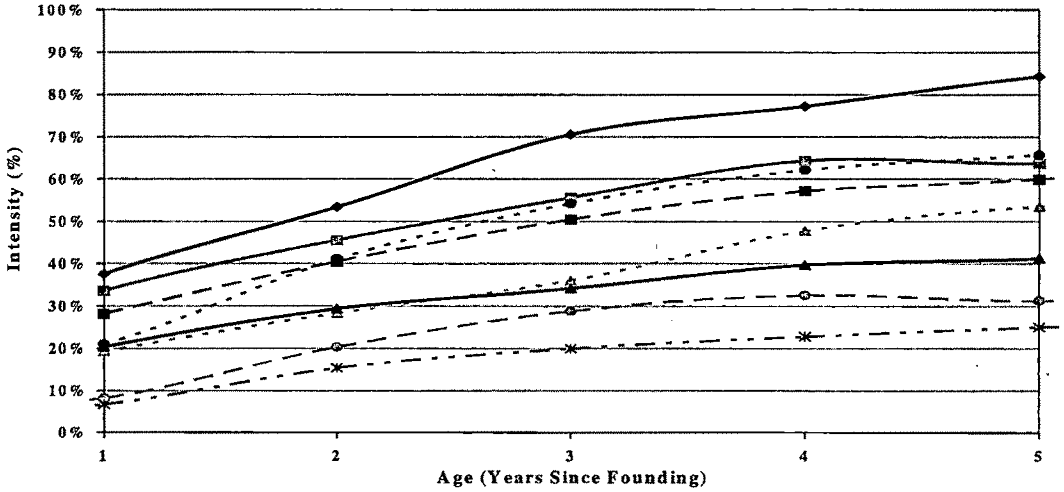
Product Development Management	Project milestones	14	29	40	45	51
	Product concept testing process	9	18	19	24	26
	Reports comparing actual progress to plan	8	19	30	37	45
	Project selection process	8	15	25	31	36
	Product portfolio roadmap	6	15	26	29	36
	Budget for development projects	6	18	30	35	41
	Project team composition guidelines	5	14	17	19	21
Sales/Marketing Management	Sales targets for salespeople	8	12	34	44	49
	Market research projects	6	10	17	24	26
	Sales force compensation system	6	10	32	44	47
	Sales force hiring and firing policies	5	10	19	23	22
	Reports on open sales	4	6	22	33	38
	Customer satisfaction feedback	4	9	14	23	27
	Sales process manual	3	4	9	15	18
	Sales force training program	1	3	18	25	29
	Marketing collaboration policies	1	3	6	12	14
	Customer relationship management system	1	8	12	23	29
Partnership Management	Partnership development plan	5	8	16	23	25
	Policy for partnerships	3	6	13	17	19
	Partnership milestones	1	5	13	16	19
	Partner monitoring systems	1	5	14	17	21

For each system, we asked respondents for the date when the system was adopted. The questions' instructions were: "For each system below, please indicate when your company formalized it; formalized is defined as having documented a process and/or periodically and purposefully executing the process."

written performance objectives for managers, and linking compensation to performance). The percentage adoption of the two management accounting system categories in the top ten increases over time as individual systems from the Financial Evaluation category enter the "Top Ten":

FIGURE 1
Early-Stage Company Evolution of Management Control Systems: Cumulative Intensity of Adoption over Time (Years Since Founding)

Panel A: Full Sample



Panel B: Venture Capital-Backed Company Sample

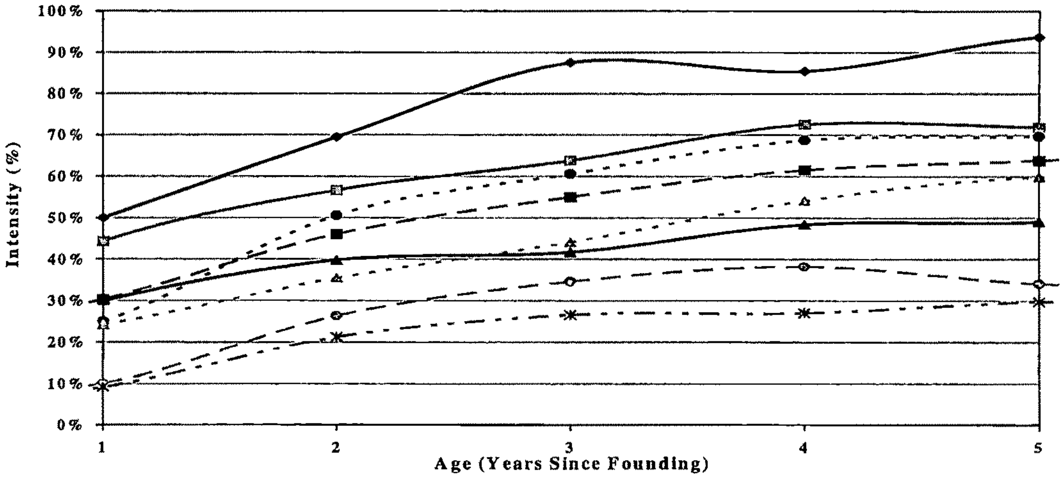


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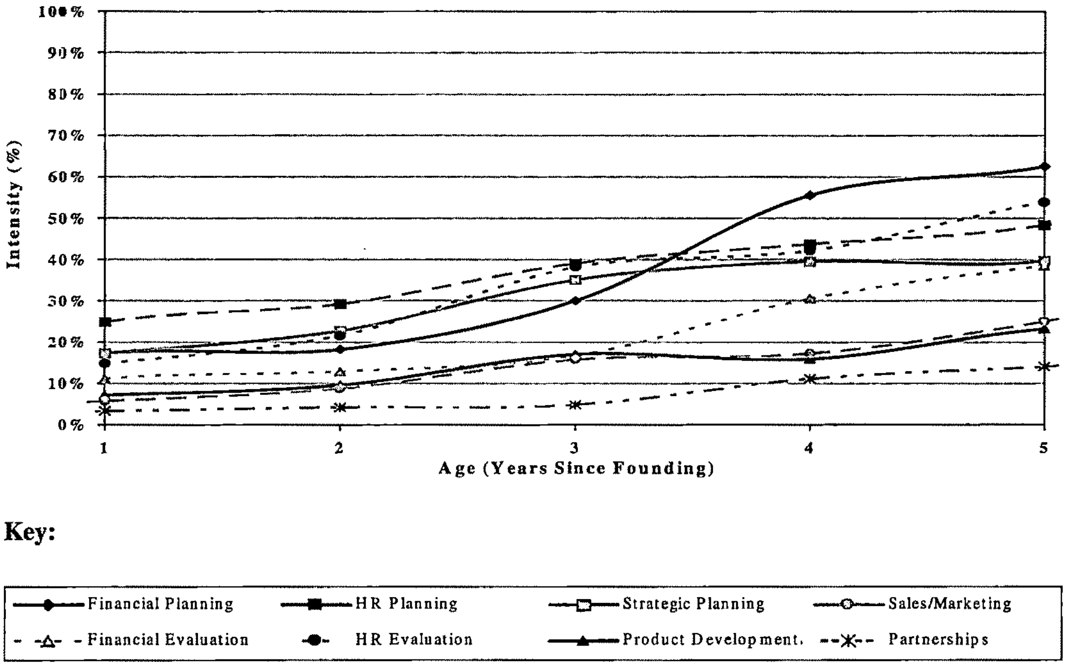
FIGURE 1 (continued)

Panel C: Non-Venture Capital-Backed Company Sample



Each individual system within each category in Table 2 is equally weighted. The percentage of systems adopted in each category is plotted over time since company founding.

	Year 1	Year 2	Year 3	Year 4	Year 5
Financial Planning	20.0%	30.0%	30.0%	27.3%	27.3%
Financial Evaluation	0.0	0.0	0.0	9.1	27.3
Total	20.0%	30.0%	30.0%	36.4%	54.6%

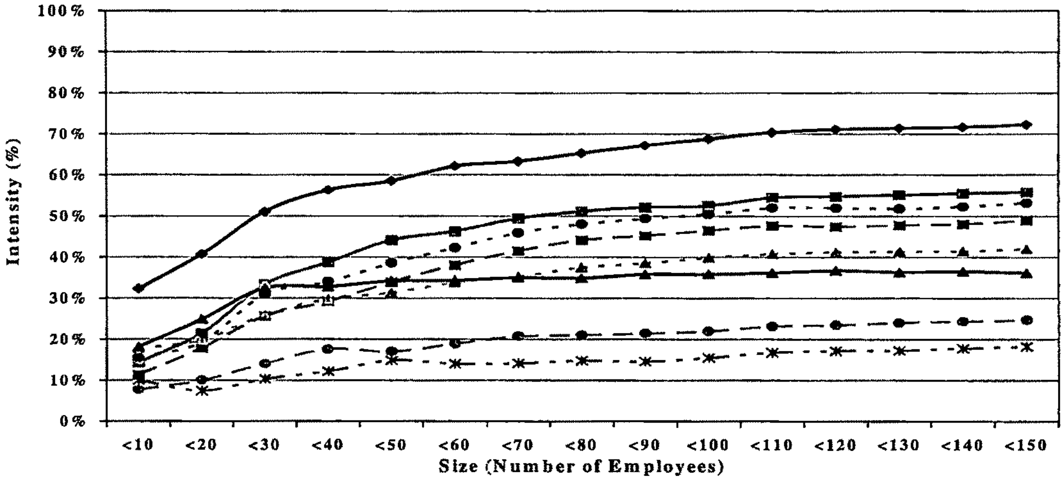
The Sales/Marketing and Partnership categories have no individual systems represented in the "Top Ten" in Years 1 to 5.

Influence of Venture Capital Financing

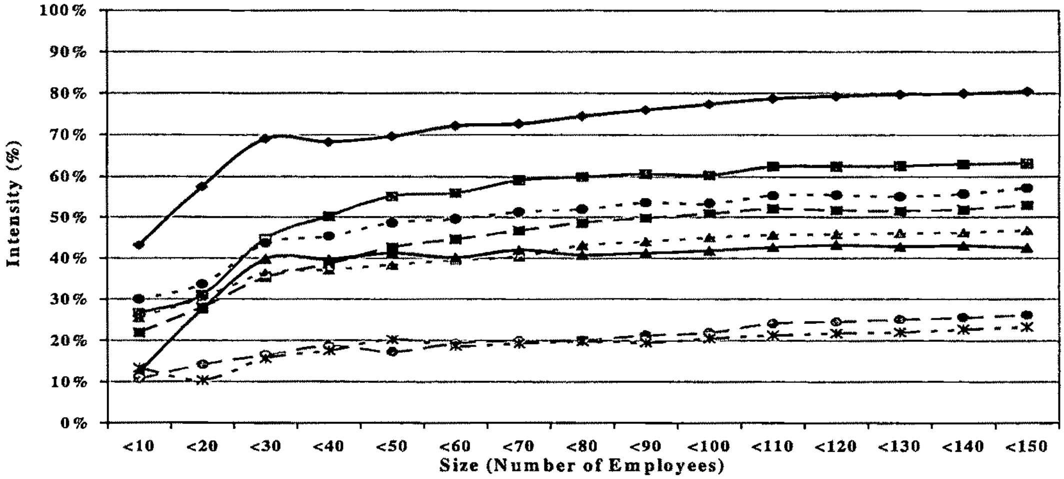
The advent of venture capital financing has been found by prior research to speed up the professionalization of management systems (see Section II). The 78 companies in this research include 60 with venture capital (VC) financing and 18 with no venture-capital (non-VC) financing. Several issues can be probed with these two subsamples. One issue is whether VC-backed companies adopt more systems at an earlier stage. Figures 1 and 2 (Panel B for VC-backed companies and Panel C for non-VC-backed companies) highlight the buildup of the MCSs in the eight categories over time and over company size levels. The general pattern in both Figures 1 and 2 indicates that VC-backed companies build up their systems much faster, and to a larger extent.[8] From the interviews, we identified three main reasons why there is such a disparity between VC-backed and non-VC-backed firms. First, VC-backed companies grow much faster than the non-VC companies and the demand

FIGURE 2
Early-Stage Company Evolution of Management Control Systems: Cumulative Intensity of Adoption for Company-Size (Number of Employees)

Panel A: Full Sample



Panel B: Venture Capital-Backed Company Sample



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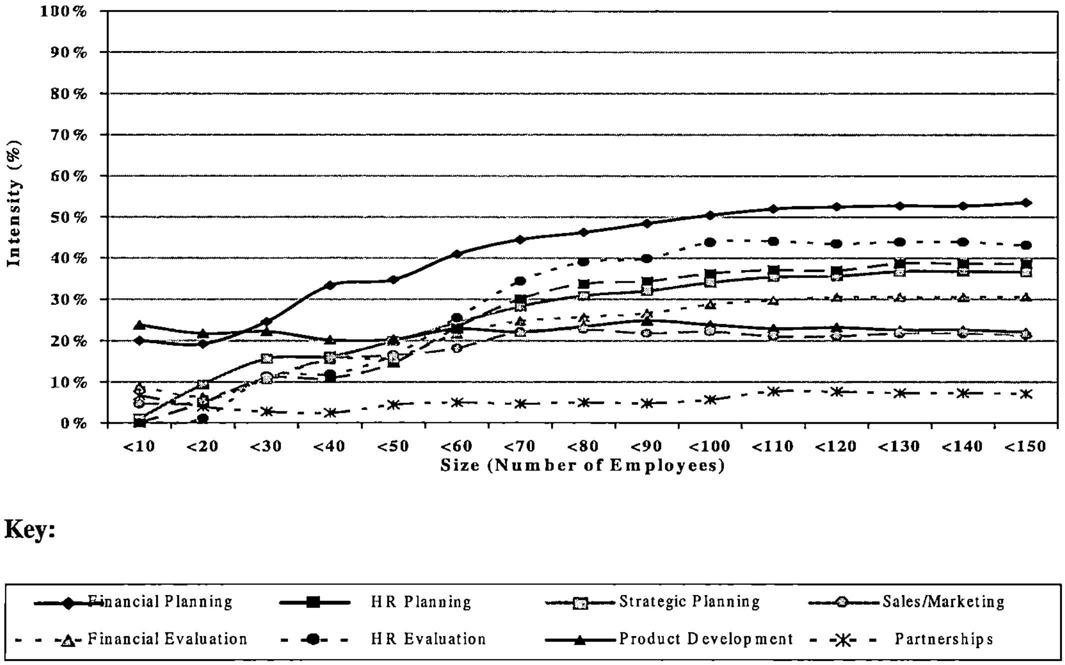
[8] VC-backed companies are defined as those that receive venture capital funding at some point during their lives. Some of the VC-backed companies may not have received this funding in the early years.

FIGURE 2 (continued)

Panel C: Non-Venture Capital-Backed Company Sample



Each individual system within each category in Table 2 is equally weighted. The percentage of systems adopted in each category is plotted over the size measured as number of employees.

for MCSs is higher—slower growth firms can adopt informal working practices over time but VC-backed firms do not have the time to search and find these informal practices. Second, the need for venture capital is characteristic of companies that are cash flow negative earlier in their lives. Financial planning facilitates companies that are cash-constrained making good use of cash and negotiating a new round of funding with enough time for the negotiation process. Third, as illustrated in the quotes in the Appendix, venture capitalists "impose" some of those systems—mainly in financial planning and evaluation and strategic planning—and other times they bring them into the company through the hiring of key managers.

The pattern for non-VC-backed companies indicates that financial planning does not dominate the adoption of systems as much as in VC-backed firms, and HR planning, strategic planning, and HR evaluation come in earlier than financial planning as far as Year 4. The later adoption of financial-planning systems (Figure 1, Panel C versus Figure 1, Panel B) together with these systems being the most frequently adopted in companies with more than 30 employees (Figure 2, Panel C) suggests that the delay in adoption documented in Figure 1, Panel C may be associated with non-VC-backed companies growing more slowly.

There is also a difference in the mix of MCS category adoption between the VC-backed companies and the non-VC-backed companies. Table 3 (Panels B and C) presents the top ten individual systems adoption mix for these two subsamples. The VC-backed companies,

TABLE 3
MCS Category Percentage Composition of "Top Ten" Most Adopted Individual Systems: Full Sample of 78 Companies

	Year 1	Year 2	Year 3	Year 4	Year 5
Panel A: All Companies					
Financial Planning	20.0%	30.0%	30.0%	27.3%	27.3%
Financial Evaluation	0.0	0.0	0.0	9.1	27.3
Human Resource Planning	40.0	40.0	40.0	27.3	18.2
Human Resource Evaluation	0.0	0.0	20.0	27.3	18.2
Strategic Planning	30.0	30.0	10.0	9.1	9.1
Product Development Management	10.0	0.0	0.0	0.0	0.0
Sales/Marketing Management	0.0	0.0	0.0	0.0	0.0
Partnership Management	0.0	0.0	0.0	0.0	0.0
Panel B: VC-Backed Companies					
Financial Planning	30.0	30.0	30.0	27.3	30.0
Financial Evaluation	20.0	0.0	10.0	27.3	30.0
Human Resource Planning	20.0	30.0	20.0	18.2	10.0
Human Resource Evaluation	0.0	0.0	10.0	9.1	10.0
Strategic Planning	20.0	30.0	30.0	18.2	20.0
Product Development Management	10.0	10.0	0.0	0.0	0.0
Sales/Marketing Management	0.0	0.0	0.0	0.0	0.0
Partnership Management	0.0	0.0	0.0	0.0	0.0
Panel C: Non-VC-Backed Companies					
Financial Planning	0.0	10.0	8.3	20.0	20.0
Financial Evaluation	0.0	0.0	0.0	0.0	13.3
Human Resource Planning	54.5	60.0	50.0	40.0	33.3
Human Resource Evaluation	27.3	20.0	25.0	30.0	20.0
Strategic Planning	18.2	10.0	16.7	10.0	13.3
Product Development Management	0.0	0.0	0.0	0.0	0.0
Sales/Marketing Management	0.0	0.0	0.0	0.0	0.0
Partnership Management	0.0	0.0	0.0	0.0	0.0

For each year, we rank the 46 systems from the most adopted to the least adopted system and identify the top ten systems. The table reports the percentage of systems within each category that made it into these top ten systems.

on balance, have a higher percentage of the top ten systems in the Financial Planning and Financial Evaluation categories than do the non-VC-backed companies. Using the percentages in Table 3, the combined percentages of these two management accounting categories across the two subsamples are:

	Year 1	Year 2	Year 3	Year 4	Year 5
VC Companies	50.0%	30.0%	40.0%	54.6%	60.0%
Non-VC Companies	0.0%	10.0%	8.3%	20.0%	20.0%

There are several possible explanations for VC-backed firms giving higher priority to the Financial Planning and Financial Evaluation categories. One explanation is that venture capitalists come with much experience about management challenges in successfully growing early-stage companies. This extensive experience leads them to give higher emphasis to adopting management accounting type systems in the early phases of a company's growth. Another explanation is that VC-backed firms typically require multiple rounds of private finance before they are cash-flow positive. Early-stage companies that are cash-flow negative may well require more careful monitoring of financial aspects of their business compared to companies not so constrained financially. A third explanation is that entrepreneurs of VC-backed companies wish to achieve positive cash-flow/profitability at the earliest possible stage (say, to avoid subsequent equity ownership dilution) and view financial planning/financial evaluation MCSs as a key tool in this objective.[9]

Many companies receive Series A venture capital funding when they are in an early formative stage with limited buildup of their MCS portfolio. Figure 3 and Table 4 highlight the dramatic impact of VC funding. Companies receiving Series A venture capital funding already have higher adoption of MCSs than non-VC funded companies of comparable age or headcount. However, between Series A and Series B there is a quantum buildup in the MCSs of these companies. This buildup in MCSs from Series A to B occurs in a short time-frame. For 43 (27) out of the 46 MCSs, there is a 50 percent (100 percent) or higher increase in adoption between the Series A to Series B funding. The mean (median) time from company formation to Series A is 2.1 years (1.5 years), from Series A to Series B 1.28 years (1 year), from Series B to Series C 1.40 years (1 year), and from Series C to Series D 1.39 years (1 year).

V. MCS ADOPTION AND COMPANY GROWTH

An important need for MCSs comes from the coordination and monitoring costs that increase as the complexity of the company (and in particular the complexity associated with a growing number of employees) increases. Small companies typically do not need these systems and empirical evidence has found strong evidence for company size being associated with the adoption of these management systems (see Baron et al. 1996; Davila 2005; and Section IV of this paper).[10] They are adopted to overcome the limitations of informal management styles that require constant personal interaction. As a manager in our sample described it: "We had management by personality and it became evident that that wouldn't scale. We figured our personalities can go through one floor and two walls. After that management by personality doesn't work anymore." This section probes the hypothesis of a positive relationship between MCS intensity and company growth. MCS intensity is computed in a two-stage process. First we compute the MCS category intensity as the percentage of individual systems adopted in each of the eight categories for each year.

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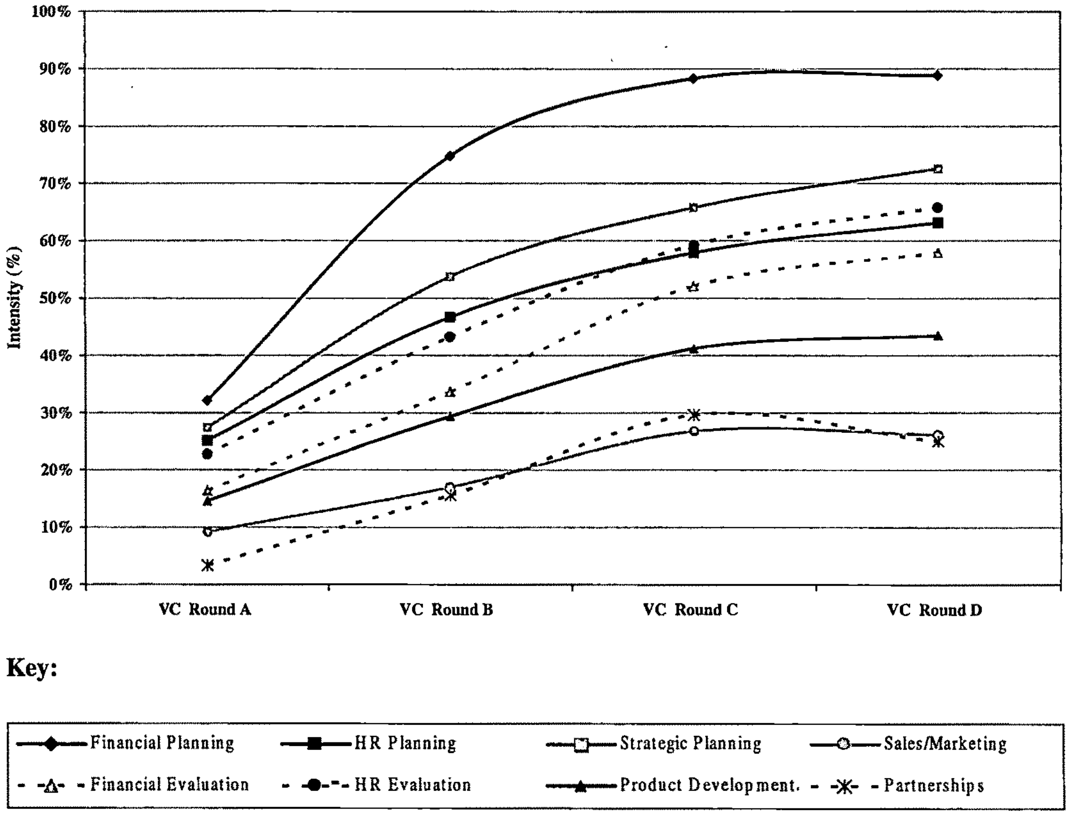
[9] We also examined whether the pattern of adoption was different among different VC categories. In particular, we identified VC firms among the top 10 and top 20 in number of deals from Venture One over the period in which the firms in the sample received venture funding; we then compared time-to-adoption for each of the 46 systems between startups funded by VC firms in these two groups and the rest of the VC-backed companies. Only "marketing collaboration policies" (shorter for top VC startups) and "company-wide newsletter" (shorter for non-top VC startups) were significant at the 10 percent level (two-tailed).

[10] An alternative role of MCS is to prevent company failure due to a major catastrophe that was not adequately controlled for through MCS. Addressing this alternative role of MCS requires a different research design where company failure is the dependent variable.

FIGURE 3
Early-Stage Company Evolution of Management Control Systems: Cumulative Intensity of Adoption by Venture Capital Funding Round



Each individual system within each category in Table 2 is equally weighted. The percentage of systems adopted in each category is plotted for companies going through the different rounds of funding.

Then, overall systems' intensity is calculated as the equal-weighted sum of the eight intensities.[11] Company growth is measured by number of employees at the end of each year.

Figure 4 provides initial evidence on the relationship between company size and MCS intensity. It plots the average company size over time for three portfolios. Portfolio 1 is formed with the companies in the highest third in terms of systems' intensity in Year 2. Portfolio 2 is formed with the medium-intensity companies, and Portfolio 3 is formed with the third of companies with lowest intensity in Year 2. The plot suggests an association between intensity in Year 2 and company size over time. Means and medians tests between

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[11] Each MCS category intensity measure varies from 0 (for a company year that adopts none of the individual systems in that category) to 1 (for a company year that adopts all of the individual systems in that category).

TABLE 4
MCS Adoption Percentage by Round of Venture Capital Financing for 46 Individual Systems in Eight Categories: Sample of 60 Venture-Finance Companies[a]

Percentage of companies having adopted the system by the end of:		**Round A**	**Round B**	**Round C**	**Round D**
Financial planning	Cash flow projections	35%	78%	90%	86%
	Operating budget	31	78	88	90
	Sales projections	31	69	88	90
Financial evaluation	Capital investment approval procedures	25	55	80	86
	Operating expenses approval procedures	24	51	78	81
	Routine analysis of financial performance against target	18	49	83	86
	Customer acquisition costs analysis	11	14	23	29
	Customer profitability analysis	11	14	20	33
	Product profitability analysis	9	18	30	33
Human resource planning	Core values	31	48	58	58
	Mission statement	31	48	63	63
	Organizational chart	31	69	82	79
	Codes of conduct	22	44	47	63
	Written job descriptions	26	54	63	58
	Orientation program from new employees	26	44	61	79
	Company-wide newsletter	7	21	32	42
Human resource evaluation	Written performance objectives for managers	26	48	61	53
	Written performance evaluation reports	26	52	71	79
	Linking compensation to performance	22	42	58	68
	Individual incentive programs	17	31	47	63
Strategic planning	Definition of strategic (nonfinancial) milestones	33	63	76	84
	Customer development plan	28	48	61	74
	Headcount/human capital development plan	28	54	66	74
	Product portfolio plan (plan about future products)	26	52	63	79
	Investment budget	22	52	63	53

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TABLE 4 (continued)

Percentage of companies having adopted the system by the end of:		**Round A**	**Round B**	**Round C**	**Round D**
Product development management	Project milestones	25%	40%	60%	57%
	Product concept testing process	17	26	33	39
	Reports comparing actual progress to plan	15	34	49	57
	Project selection process	12	30	40	39
	Product portfolio roadmap	12	28	40	43
	Budget for development projects	12	28	47	48
	Project team composition guidelines	10	19	21	22
Sales/marketing management	Sales targets for salespeople	13	28	49	48
	Market research projects	12	19	26	17
	Sales force compensation system	15	30	49	43
	Sales force hiring and firing policies	8	15	19	17
	Reports on open sales	12	17	33	35
	Customer satisfaction feedback	7	17	23	17
	Sales process manual	8	8	14	13
	Sales force training program	7	17	30	30
	Marketing collaboration policies	5	8	9	13
	Customer relationship management system	5	11	16	26
Partnership management	Partnership development plan	7	17	33	35
	Policy for partnerships	3	15	30	22
	Partnership milestones	2	15	28	22
	Partner monitoring systems	2	15	28	22

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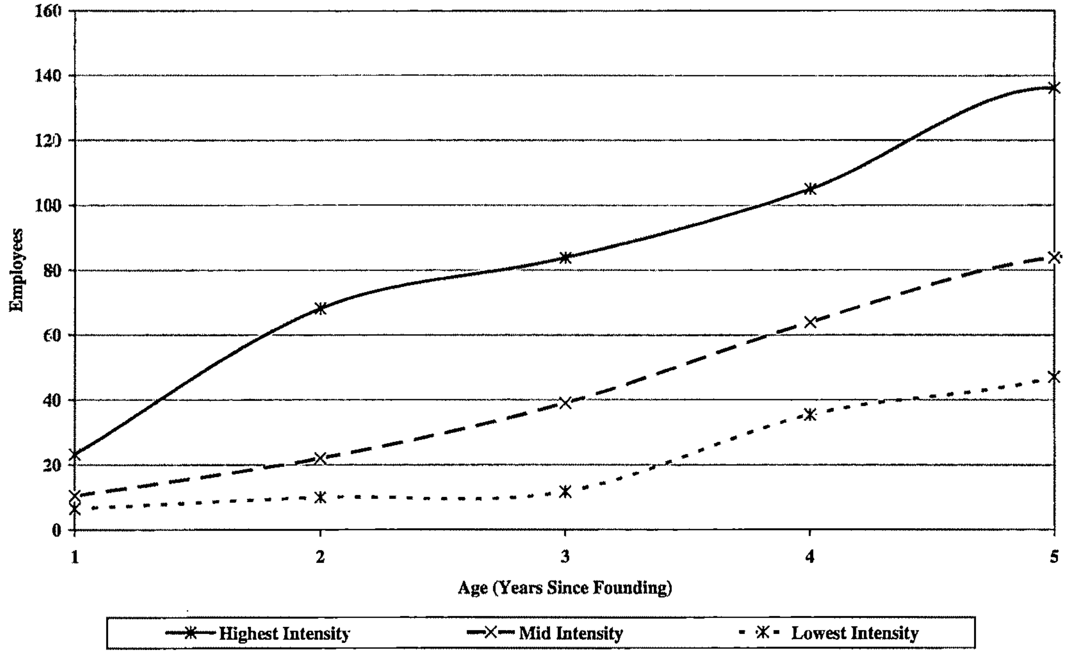
[a] 60 firms in the sample had Round A, 53 had a Round B, 43 had a Round C, and 23 had a Round D. The declines in percent usage in some systems are due to declines in the sample rather than those specific systems being abandoned.

FIGURE 4
Management Control Systems' Intensity and Employee Growth



This figure plots average company size over time for three portfolios. Each company in the sample is assigned to one of the portfolios according to its systems' intensity in its second year of existence. Each portfolio has an equal number of firms. Portfolio (1) is formed with the 33 percent of companies with highest intensity, portfolio (3) is formed with the 33 percent of companies with lowest intensity, and portfolio (2) is made up of the rest of firms.

the various portfolios are significant from Year 2 onward. Similar results are obtained if the portfolios are formed in Year 1 or Year 3.[12]

In addition to company size being a driver of the MCS intensity, the prior literature has argued that growth itself is possible only if these systems are in place.[13] In other words, these systems provide the management infrastructure required to scale up the business model.

These arguments suggest that the relationship between company size and the intensity of MCSs goes both ways. We model the endogeneity of these two variables using a simultaneous equations model. The first equation uses number of employees as proxy for company size. The second equation uses MCS intensity as a measure of rate of adoption:

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[12] We also used cluster analysis to group firms based on their patterns of adoption of the 46 systems. Clustering the firms into three groups and plotting growth for each of the groups led to graphs very similar to the one reported in Figure 4.

[13] Greiner (1998), in a well-know article on company growth, described the need for systems as the "control revolution" required for companies to continue on its growth path.

$$\text{Employees} = f(\text{MCS intensity, control variables}); \quad (1)$$

$$\text{MCS Intensity} = f(\text{employees, control variables}). \quad (2)$$

To ensure identification of the system of equations, both equations require additional variables. In addition to MCS intensity, we include two additional variables in the first equation—revenues and cumulative funding—that arguably impact company growth. In equilibrium, companies will hire the number of employees required to satisfy demand for the company products. We use revenues to proxy for demand in the company's product market. Market demand is assumed to be driven by customer needs, an exogenous variable that affects number of employees. In other words, the company hires more employees to satisfy this latent demand (exogenous to the company). In addition to external demand, growth may come from the need to develop technology, products, and markets. We proxy this internal demand for growth using the cumulative funding that a company has received.[14] External funding depends on the attractiveness of the company's business model, which is exogenous to the current size of the company. These two variables impact MCS intensity through their effect on number of employees—the hypothesized driver of MCS needs—as captured in the second equation.[15]

In addition to number of employees, our second equation includes the following variables. It has been argued that venture capitalists professionalize the companies that they fund faster (Hellmann and Puri 2002; Davila and Foster 2005; and Section IV of this paper). While size of VC funding is expected to positively impact the number of employees (Equation (1)), prior findings (Davila and Foster 2005) suggest that the presence of venture capital (regardless of the funding amount) affects certain MCSs, regardless of size.[16] We include a dummy variable that takes a value of 1 for those company-years in which the company has venture capital investors. CEOs with more experience are more likely to have been exposed to MCSs and therefore be knowledgeable about their benefits and costs. If, on average, the adoption of these systems trails behind company needs, then we expect CEO experience to accelerate their adoption.[17] We also include a dummy variable that takes the value of 1 if the original CEO has been replaced.[18,19] Entrepreneurs may have a hard time transitioning into a manager's mindset (Chandler and Jansen 1992; Willard et al. 1992). While many managers rely on MCSs, some entrepreneurs perceive them as killing the entrepreneurial spirit. Therefore, we expect this CEO replacement variable to have a positive effect (Davila and Foster 2005). We also include a dummy variable that takes a value of 1 if the company is beyond the pre-revenue stage. We expect pre-revenue stage companies to require fewer systems.[20] We also control for the potential complexity that having international operations brings to a company's needs for MCSs. This variable takes the value of 1 for those years in which the company had international activities. The Appendix provides quotes from the research interviews that illustrate the potential relevance of these variables to explain MCS intensity. Finally, we control for industry.[21,22]

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[14] We asked the CFO of each company to provide a financial history of the company with the dates of funds inflow—in most cases venture capital investments, the amount invested, and company valuation. This information was contrasted with Venture One and Venture Economics data. In most cases, both sources provided the same information; when in conflict, we reconfirmed the data with the CFO. Also from the CFO we gathered the revenue history of the firm since founding.

[15] As in any field research study, it is difficult to identify exogenous variables because in companies many variables often move together. The underlying assumption to treating revenues as exogenous is that the company is somehow behaving optimally and it has the people it needs to be able to serve up to the last marginally profitable sale. Thus, if a potential profitable market for the company increases, then it will hire the people it needs to satisfy this new level of revenues. In other words, companies can quickly adjust its employees to reach the optimal level of revenues; if companies stay in the transition period (unable to hire enough people to meet demand) for long periods of time, then the assumption is weak. Similarly, cumulative funding can be argued to also affect MCS intensity. The assumption behind our model is that it is not as much the total dollars invested that drives MCS as the presence of professional investors (this is why we have the variable "venture backed" in the second equation). This two-equation simultaneous model addresses the endogeneity problem to the extent we believe it can be addressed. However, the test rests on the validity of the arguments behind treating certain variables as exogenous. To check the robustness of the results we run different models of this two-equation model such as dropping some of the variables (revenues, industry dummies, time-to-revenue, or international). The relationship between employees and MCS intensity remained significant in these robustness tests.

[16] The presence of venture capital is associated with the quality of the business model, which is exogenous to our model.

[17] The underlying assumption is that CEO experience impacts number of employees through his or her likelihood of adopting MCS.

Table 5 reports Pearson and Spearman correlations. Variables are significantly correlated. In particular, MCS intensity and employees are highly associated. The pattern of both types of correlations is similar, indicating that Pearson correlations are not driven by extreme observations.

We examined the simultaneous equation model for the possibility of auto-correlated error terms. We found this to be a problem in Equation (2), and model the error term using a first order auto-correlation model. In addition to the information technology (IT) industry, we further control company attributes using a random-effects model. We ran a Hausman test comparing the more efficient random-effects model with a fixed-effect model and did not reject the equality of coefficients.

Our final specification is:

$$\begin{aligned}\text{Employees} = {} & \alpha_0 + \alpha_1 \text{ MCS Intensity} + \alpha_2 \text{ Revenues} \\ & + \alpha_3 \ln(\text{Cumulative Funding}) + \varepsilon; \end{aligned} \tag{1}$$

$$\begin{aligned}\text{MCS Intensity} = {} & \beta_0 + \beta_1 \text{ Employees} + \beta_2 \text{ VC-Backed} + \beta_3 \text{ CEO Experience} \\ & + \beta_4 \text{ Founder Replaced} + \beta_5 \text{ Post-Revenue} + \beta_6 \text{ International} \\ & + \beta_7 \text{ IT Industry} + \varepsilon(\text{AR1}). \end{aligned} \tag{2}$$

Table 6 reports the results. The coefficient on MCS intensity (α_1) is positively associated with employee growth. This is consistent with the predicted relevance of these systems to the growth of startup firms. Revenues (α_2) and cumulative funding (α_3) are also positive and significant. These findings are consistent with external demand and the availability of resources to meet internal needs for employees being associated with company growth.

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[18] We collected the CEO history from the CEO questionnaire where we asked for the dates in which a new person was appointed CEO and this person's years of experience and whether the experience was with startup firms. We contrasted this information during the CEO's and business development manager's interviews.

[19] CEO replacement may be driven by the lack of MCS intensity and then this variable is endogenous to the model we are estimating. We ran the same model without CEO replacement and the inferences remained unchanged.

[20] Pre-revenue stage is driven by whether the technology has moved to a commercial product. While the quality of MCS in product development may have an effect on the pre-revenue stage, we are assuming that the effect is small and that the pre-revenue stage is determined by factors unrelated to size or MCS intensity. The low adoption of product development MCS in the early years suggests that the assumption is likely to be valid. Moreover, the first commercial product is often brought to the market by a small team.

[21] Wooldridge (2005) describes the criteria for selecting the independent, exogenous variables.

[22] We include a control for industry in the second equation rather than the first because revenues and funding are likely to capture the differences in growth across industries. None of the exogenous variables is likely to capture the effect of industry. For instance, the fact that IT firms may need to hire a much larger sales force than biotechnology or other industries is not captured by the exogenous variables.

TABLE 5
Correlation Table

	Number of Employees	MCS Systems' Intensity	Revenues	Ln(Cumulative Funding)	CEO Experience	VC-Backed	CEO Replaced	Time to Revenue	International Operations	Biotech Industry
Number of Employees		0.38***	0.50***	0.43***	0.46***					
MCS Systems' Intensity	0.44***		0.10*	0.45***	0.16***					
Revenues	0.60***	0.23***		0.15***	0.11*					
Ln(Cumulative Funding)	0.55***	0.47***	0.19***		0.23***					
CEO Experience	0.15**	0.16***	−0.03	0.25***						
Venture Capital Backed	0.37***	0.22***	−0.11**	0.29***	0.37***					
Founder Replaced	0.37***	0.34***	0.17***	0.30***	0.39***	0.29***				
Time to Revenue	0.65***	0.04	0.50***	0.06	0.42***	0.27***	0.25***			
International Operations	0.38***	0.51***	0.18***	0.24***	0.27***	0.21***	0.45***	0.21***		
Biotech Industry	0.00	−0.02	−0.10**	0.28***	−0.01	0.17***	0.07*	0.00	0.00	
IT Industry	−0.03	0.15***	−0.12**	0.06	0.07	0.07	0.01	−0.04	0.05	−0.65***

*, **, *** Indicates significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The upper triangle reports Pearson correlation and the lower triangle reports Spearman correlation. Pearson correlations are not reported for dummy variables.

TABLE 6
Firm Growth and Management Control Systems' Intensity

Equation 1: Employees	
Constant	−87.54**
	(−2.55)
MCS Intensity	30.38**
	(3.70)
Revenues	0.002***
	(6.68)
Ln(Cumulative Funding)	62.52***
	(3.91)
Chi-square	196.67***
Overall R^2	0.36
Equation 2: MCS Intensity	
Constant	−0.81**
	(−2.50)
Employees	0.006***
	(3.97)
Venture Capital Backed	0.247*
	(1.79)
CEO Experience	0.004
	(0.50)
Founder Replaced	0.053
	(0.45)
Time to Revenue	0.246**
	(1.97)
International Operations	0.416***
	(4.09)
Biotech Industry	−0.218
	(−0.67)
IT Industry	0.181
	(0.52)
Chi-square	90.28***
Number of observations	264

*, **, *** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
z-stat in parenthesis.
The table reports iterative, random effects simultaneous equations model estimation.

Employees = number of employees at the end of each year;
MCS Intensity = sum of the percentage of systems adopted within each type of management control system;
Venture Capital Backed = value of 1 for those company-years in which the company had venture capital in its equity, and 0 otherwise;
CEO Experience = years of experience of the CEO when (s)he became CEO;
Founder Replaced = dummy variable that takes value of 1 for company-years in which the CEO is not the founding CEO;
Time to Revenue = dummy variable that takes value of 1 for company-years beyond the pre-revenue stage;
International Operations = value of 1 if the company has international activities, and 0 otherwise; and
IT Industry and Biotech Industry = dummy variables that take value of 1 for those firms in the IT or biotech sector.

In Equation (2), the number of employees (β_1) is significantly associated with MCS intensity. This finding is consistent with predictions and with previous empirical evidence that identified company size as a relevant variable to explain the adoption of MCS. The coefficient on the presence of venture capital (β_2) is positive and significant, consistent with this type of capital bringing "professional" systems to companies. Also companies beyond the pre-revenue stage (β_5) and with international activities (β_6) are positively associated with the intensity of MCSs.[23]

In summary, the findings are consistent with company growth and MCSs being interrelated. These systems are needed to provide the management infrastructure that supports growth beyond the informal stage; simultaneously, these systems are needed only if growth exists. The results in Table 6 establish association but not causality. The current research design is consistent with two (not necessarily inconsistent) hypotheses—(1) that an increase in MCS intensity facilitates future company growth, and (2) that managers anticipate future growth and increase MCS intensity to enable them to "manage that growth."[24]

VI. PERFORMANCE IMPLICATIONS: CEO ROTATION AND MCSs

The replacement of entrepreneurs at the CEO position has been frequently associated with the difficulty such individuals experience in transitioning into a manager's mindset (Chandler and Jansen 1992; Willard et al. 1992). A powerful indicator of this transition is the adoption of MCSs. Figure 5 provides descriptive evidence relevant to this question. We classified firms into three groups according to MCS intensity in Year 1 from high to medium and low intensity. For each group we estimated the proportion of founders that were replaced during the years for which we have data. Panel A in Figure 5 reports these proportions. We reclassified firms into groups in Year 2 (Panel B) and again in Year 3 (Panel C). Figure 5 suggests an association between MCS intensity and founder's replacement as CEO.

Given the survival nature of the data, we use a Cox specification model and report hazard ratios. Table 7 examines this same question in a multivariate setting. We examine two different models. The dependent variable in the first model is the time since founding to the replacement of the founder as CEO. The dependent variable in the second one is the time to replacement of a CEO from his or her hiring date regardless of whether this person was a member of the founding team. The second model takes advantage of the additional information in our database about CEO tenure beyond the founding CEO.

If MCS intensity is associated with an entrepreneur (or CEO in the expanded model) being able to transition into a managerial role, then we expect intensity to be associated with longer tenure. In addition, we control for the number of employees, industry, CEO experience and whether this experience is in startup firms, as well as whether the firm is VC-backed. Employees capture the potential effect of company performance—more successful CEOs may build their companies faster and have longer tenures. Industry reflects the different time frames across industries, with information technology having a faster ramp-up than biotechnology. Prior research suggests that venture capitalists are faster at replacing the founder as CEO (Hellmann and Puri 2002). Finally CEO experience, and whether this experience was gained in startup companies, control for the background of

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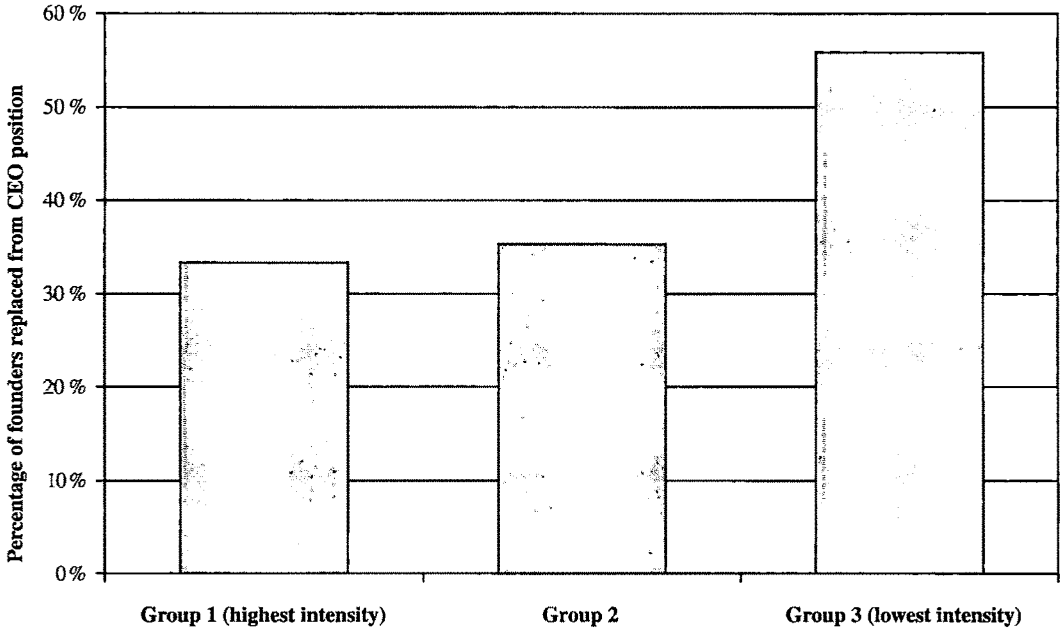
[23] We examined the late adoption of sales management systems. As expected, we found that sales management intensity was associated with whether the firm had reached the selling stage (time-to-revenue variable). Size (number of employees) and the information technology dummy were also significant.

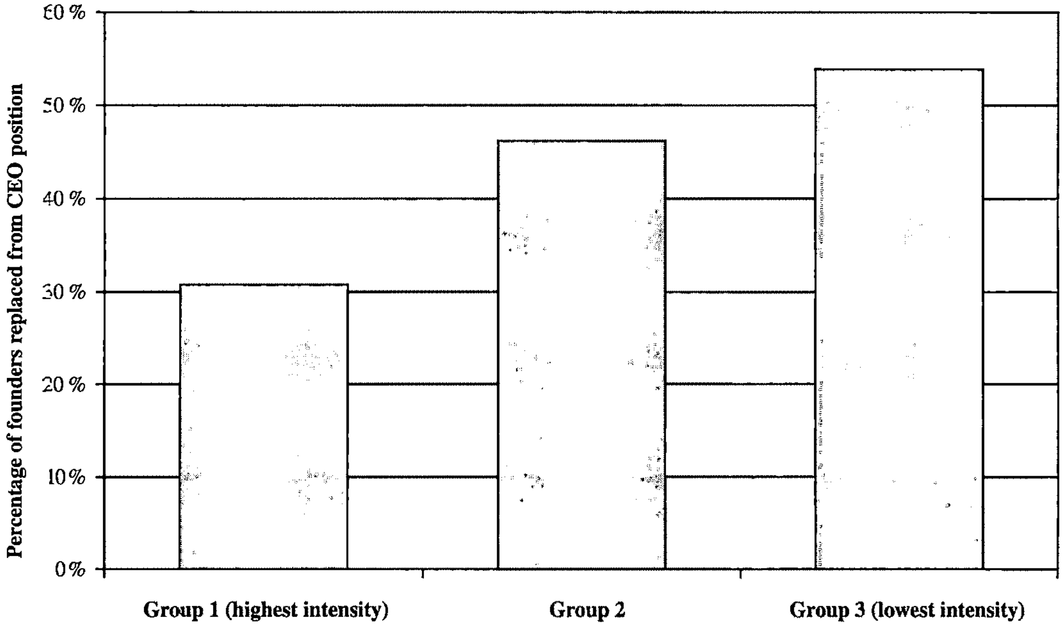
[24] One venture capitalist who commented on the research argued that in a narrow sense Table 4 did establish causality. He noted that venture funding facilitated growth after each funding round and that Table 4 highlighted the quantum increase in MCSs Series B that venture capitalists required before the new venture money was invested.

FIGURE 5
CEO Turnover and Management Control Systems' Intensity

Panel A: CEO Turnover and Management Control Systems' Intensity—Year 1



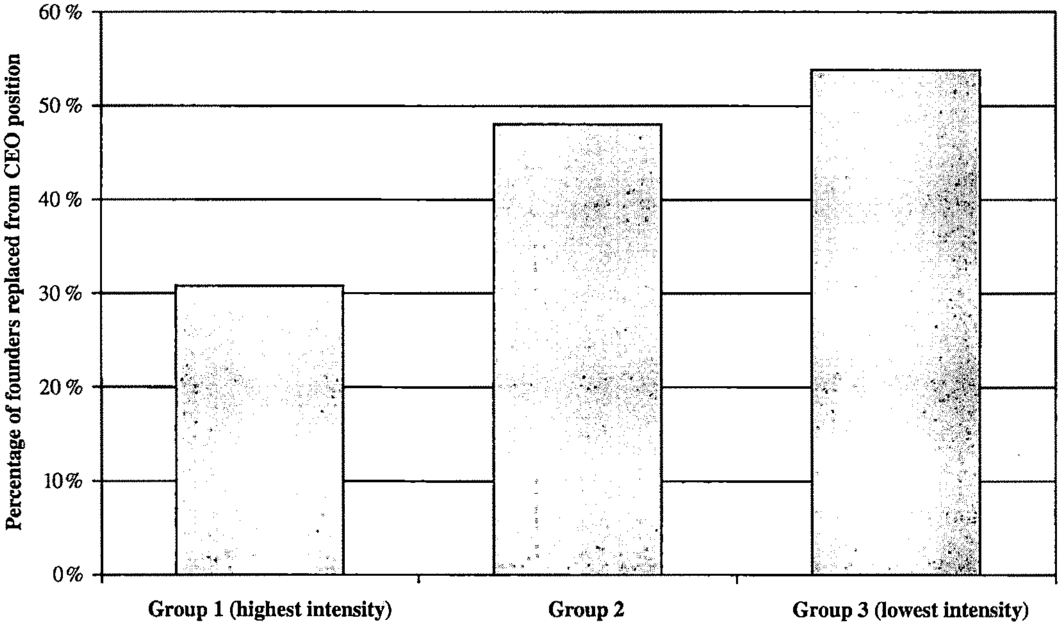
Panel B: CEO Turnover and Management Control Systems' Intensity—Year 2



(*continued on next page*)

FIGURE 5 (continued)

Panel C: CEO Turnover and Management Control Systems' Intensity—Year 3



These figures plot the percentage of founders replaced from the CEO position per level of management control systems' intensity. Firms were grouped into three portfolios from highest to lowest intensity in Year 1 (Panel A), Year 2 (Panel B), and Year 3 (Panel C). The y-axis is the percentage of founders replaced and the x-axis are the three portfolios from highest (group 1) to lowest intensity (group 3).

the CEO. CEOs with more experience and with startup experience are likely to better understand what needs to be done to grow the company.

Table 7 reports the hazard ratios. MCS intensity is significant and associated with longer tenure in both models in Table 7.[25] The coefficient for information technology is larger than 1 and significant, indicating that tenure in this industry is shorter. Company size is significant and greater than 1 in the second model but not in the first. This result is consistent with shorter tenures in larger companies. CEO experience in startups is significant in the first model (founder model), with prior startup experience being associated with shorter tenures. However, this result is after controlling for startup experience and CEO experience.

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[25] The literature has put forward the argument that founders are replaced because they are unable to transition from an entrepreneurial to a managerial mindset (see Section II). Our results are consistent with this argument. An alternative argument is that the founder knows that s/he is going to be replaced and under-invests in MCS, knowing that those systems benefit the long term of the company and not the short term (for which s/he is accountable) and that the new CEO will introduce them.

TABLE 7
Management Control Systems' Intensity and CEO Rotation

	Time to Replacing Founder as CEO		Time to CEO Replacement	
	Hazard Ratio	**z-statistic**	**Hazard Ratio**	**z-statistic**
MCS Intensity	0.365***	−2.77	0.393**	−2.37
IT Industry	3.311**	2.37	3.897**	2.28
Number of Employees	1.007	1.62	1.010**	2.24
Venture Capital Backed	2.301	1.53	1.669	0.83
CEO Experience (Years)	1.020	0.67	0.994	−0.24
CEO Startup Experience	0.002***	−2.98	1.480	0.40
Startup Experience * CEO Years of Experience	1.354***	3.77	0.929	−1.28
Number of Observations	201		272	
Number of Subjects	52		80	
Chi-square	43.24***		13.09**	

*, **, *** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

The table presents results for a Cox regression model with right censoring and time-varying covariates of CEO tenure. A coefficient of 1 indicates that the variable has no influence on the time to the event, a coefficient less (more) than 1 indicates that the variable is associated with longer (shorter) time to the event.

MCS Intensity = sum of the percentage of systems adopted within each type of management control system;
Number of Employees = number of employees at the end of each year;
Venture Capital Backed = value of 1 for those company-years in which the company had venture capital in its equity, and 0 otherwise;
CEO Experience = years of experience of the CEO when (s)he became CEO;
CEO Startup Experience = dummy variable coded 1 if the CEO has experience in startups or small firms; and
IT Industry = dummy variable that takes value of 1 for those firms in the IT sector.

This latter interaction variable is associated with longer tenure.[26] Thus, CEO experience in startup companies increases the likelihood of longer tenures.[27]

VII. CONCLUSIONS

An informal approach to managing organizations becomes harder when they grow beyond a certain size. At this point, the adoption of MCSs becomes important to provide the management infrastructure required to scale-up the organization. Modeling this transition point as a system of simultaneous equations, we find that the adoption of MCSs is positively associated with company size and, simultaneously, company size is associated with the presence of these systems. This evidence indicates that growth and the adoption of management systems reinforce each other as companies transition through their first

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[26] These results are robust to using lagged MCS intensity, which captures the potential endogeneity of MCS intensity and the presence of a new CEO in the last period of a spell (endogeneity that may emerge if new CEOs quickly build up systems after they join the company). They are also robust to including alternative measures of performance, such as change in number of employees in the period, or revenues. Finally, the coefficient on a dummy variable for the year of a founder's replacement and the year after is significant in a regression of change in MCS intensity against change in employees, employees, and this dummy variable.

[27] As an additional test, we added to the model reported in Table 7 another variable: change in MCS intensity. The idea behind this variable is that CEOs who are building up the systems are less likely to be replaced. The variable is significant at the 10 percent level (and larger than 1) for founders and not significant for CEOs in general.

"growth crisis." We also find evidence informative to the empirical regularity found in early-stage startup firms where founders are replaced as CEOs more often than expected. We find that CEOs with lower adoption of MCSs are more likely to be replaced. Overall, the evidence supports the relevance of these systems to the growth of startup firms beyond their initial stage.

The financial planning MCS category is typically the first and most widely one adopted by the startup companies examined. Three individual systems relate to financial planning—operating budgets, cash flow projections, and sales projections. Individual human resource planning and strategic planning systems are also among the first and most widely adopted MCSs, e.g., core values, organization charts, definition of strategic milestones, and headcount/human capital development budgets. Progressively over the third to the fifth years since founding, there is a sizable buildup in both financial evaluation and human resource evaluation MCSs. The financial evaluation systems that have widespread adoption in the first six years are capital investment approval procedures, operating expenses approval procedures, and routine analysis of financial performance against target.

The evidence in this paper can be extended in several ways. We treat MCSs in a dichotomous way—the company either has or has not adopted them. Future research could examine potential variation in the quality or depth of individual systems or individual categories adopted. During the data collection research phase it was not unusual to hear descriptions of these systems evolving from fairly straightforward systems to more sophisticated ones. Future research could quantify such depth or quality of system adoption.

Our research highlights the importance of venture capital (VC) to understanding the adoption of MCS. It is relevant in terms of the adoption pattern (Figures 1 and 2 showing higher adoption in VC-backed companies) and to explain MCS intensity and the adoption of planning systems. Future work may examine the adoption of MCS in these non-VC-backed companies to understand whether there are different patterns of adoption. Because of the small sample size of this type of company and the large contrast between VC-backed and non-VC-backed companies, this question is not addressed in this research.

Another important extension of this research has to do with the sequencing of MCS adoption. Theory suggests that planning systems should be adopted before evaluation systems are. However, theory is silent about which systems come first and whether the adoption of certain systems is conditional on having other systems in place. In preliminary results comparing financial, strategic, and human resource (HR) planning (not reported), we find that HR and strategic planning complement each other—the presence of one is associated with a higher likelihood of adopting the second. In contrast, the adoption of financial planning systems is associated with longer adoption times for HR and strategic planning. Future research can develop arguments on how the adoption of these systems should be sequenced, and then to empirically examine this question.

An alternative role of MCS is to control risks and avoid major catastrophes that may lead to company failure. This study does not address this question, but gathering empirical evidence on whether MCSs can assist managers to avoid failure through their role as risk monitoring devices is an important line for future research.[28]

The role of key individuals/players in building the MCS portfolio of companies is an important but little-researched topic. For instance, it was common during interviews to have descriptions of specific MCS adoption being associated with the hiring of a particular manager—the idea of "import in" knowledge. Related to this issue is the role of "third parties" in guiding MCS adoption decisions. Early-stage companies adopting product development MCSs sometimes referred to the "requirements" of third parties (such co-product developers, like Intel) or research/marketing partners (such as pharmaceutical companies) when explaining why specific MCSs were implemented. Venture capitalists represent a key third-party in our sample, as is evidenced by the greater emphasis placed on management accounting MCSs (both financial planning and financial evaluation) in VC-financed companies compared to non-VC-financed companies. Venture capitalists have vast experience with many early-stage startups and have high incentives to understand factors that increase the likelihood of company success. Management accounting and other MCS choices appear to be influenced by such third parties to a greater degree than has been previously recognized as early-stage companies build up their MCS portfolios.

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[28] Also, preliminary evidence (not reported) suggests that the presence of MCS may be related to the value that venture capitalists put on a startup company. Future research could address this additional piece of evidence on the relevance of MCS to performance.

APPENDIX

Illustrative Quotes for Variables Potentially Affecting Management Control Systems' Intensity

Variable	Illustrative Quotes
Number of Employees	"I think the systems are more important in the scaling period because what works for 20 people won't work for 50 or 200 people, in terms of communication, decision making, etc. So you need the systems to formalize and structure it more." "It definitely happened to us, when you couldn't fit everyone into one space and the dynamic shifts and communication get a lot harder."
Venture-Backed	"[These systems] were put in through a combination of the then Chief Financial Officer as well as the minimum expectations set by the VCs. So the board itself had a very strong hand in terms of what minimum it was prepared to accept." "I just find that you can't get hurt by over-reporting to the board. And reporting early." (The board had various venture capitalists on it.)
Managers' Experience	"I think some of it is just something that I've learned or I've developed over the years from experience, things that work." "He came from McKinsey and he was a very process-oriented guy. So that's when the process began, I would say." "Some systems expertise you import when you import the right people."
Founder Replaced	"Originally the sales organization was run by one of our founders who was a very, very young guy like 22 at the time or something. But he just didn't have a lot of experience running this type of organization and putting this kind of system in place. And then eventually we ended up having an experienced VP of sales and marketing join who then implemented kind of his vision of things."
Pre-Revenue Stage	"So there is a clear need for a formalized policy on communicating with each other. And also because we are getting closer to commercialization, there is a need to have a better understanding of our cost structure, which needs a very formalized approach." "There's no need to do a product profitability report because we're not shipping product." "So one of our biggest weaknesses was lack of marketing information and marketing analysis, the problem was that we didn't have the reporting tools."

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A Simulation Analysis of Interactions among Errors in Costing Systems

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ABSTRACT: Cost accounting systems provide accurate costs only under stringent conditions. However, we know little about the nature, level, and bias of costing errors. This paper reports the results of a simulation study of two-stage cost allocation systems that provide the following main insights: (1) partial improvement in the costing system usually increases the overall accuracy of reported product costs except in specific cases identified in this paper where errors have an offsetting effect, most notably when there is aggregation error in the activity cost pools and measurement error in the resource drivers; (2) the impact of Stage II costing errors on overall accuracy is stronger than that of Stage I errors, so system refinements should focus on Stage II; and (3) the presence of aggregation and measurement errors usually results in relatively more products being under- than over-costed, with large amounts of over-costing for a few "big-ticket" (in dollar terms) products, and small amounts of under-costing for a larger number of less expensive products.

Keywords: *costing system design; costing accuracy; costing error; simulation.*

Data Availability: *The simulated data sets are available from the first author on request.*

I. INTRODUCTION

Because managers base many decisions on reported product cost (e.g., Cooper and Kaplan 1988a; Drury et al. 1993; Shim and Sudit 1995) even modest distortions in product cost may create significant distortions in decision making. The analytical accounting literature (e.g., Noreen 1991; Datar and Gupta 1994; Christensen and Demski 1997) shows that cost accounting systems in general and activity-based costing (ABC) in particular provide accurate incremental cost information only under stringent conditions.

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Consequently, costing systems are unlikely to be error-free in application. While this conclusion is broadly accepted, we know little about the nature and severity of such costing errors. Improving costing accuracy requires an investment of time and money, and accountants working in an era of increasing demand for their services are constrained in both areas. Time and resources should be used where they can be expected to be most effective. It is therefore important to understand the sources of these costing errors, the biases they create, and the most effective and efficient ways to improve costing accuracy.

In this paper, we report results of a large-scale simulation that bear on these issues.[1] Building on the research framework (Kaplan and Thompson 1971; Babad and Balachandran 1993; Gupta 1993; Datar and Gupta 1994; Homburg 2001) that typically assumes *one* true costing benchmark, we simulate a wide variety of true costing systems to cover the range of potential benchmarks. For each of these benchmarks, we generate a wide variety of (false) costing system approximations, enabling us to study the sources of errors and their interactions. This approach allows us to gain insights into the determinants of costing (in)accuracy and determine whether our results generalize or hold only for a subset of costing systems.

We make three contributions. First, we present a richer development of the determinants of accuracy in costing systems as called for by Balakrishnan and Sivaramakrishnan (2002), among others. Specifically, we present new results on (1) conditions under which partial refinement of costing systems does or does *not* improve overall accuracy; (2) the impact of the various types of error on overall accuracy; and (3) the bias in reported product costs introduced by these errors. We find that significant over-costing is typically associated with a few high-valued (in dollar terms) products, whereas the degree of under-costing tends to be less severe but is associated with many lower-valued (in dollar terms) products.

Second, we explicitly account for the two-stage nature of most costing systems. Previous research (e.g., Noreen 1991; Babad and Balachandran 1993; Datar and Gupta 1994) has focused on the second-stage allocation of activity cost pools to cost objects. In contrast, we also include the first-stage allocation from resource cost pools to activity cost pools. Examining both stages exposes interactions between errors at the two stages. We find that the largest offsetting effect occurs between two types of errors in different stages of the costing system—specifically, between aggregation error in the activity cost pools in Stage II and measurement error in the resource drivers in Stage I. We also find that the impact of Stage II error on overall accuracy is stronger on average than the impact of Stage I error.

Finally, we provide practical guidance to designers and users of costing systems and cost information to inform both the trade-off between accuracy and the cost of accuracy, and the decision of where to allocate scarce resources and time to improve costing accuracy. Specifically, we show where to tolerate errors and which errors should be addressed in particular contexts.

The remainder of the paper is organized as follows. In the next section, we identify and discuss various errors in the design of costing systems. Section III explains the principal components of our simulation method. Section IV shows that, with few exceptions, partial refinement almost always increases accuracy. Section V discusses the relative impact and importance of the different types of error on the accuracy of product costs. Section VI documents the bias in product costs introduced by these errors. Section VII concludes and suggests avenues for future research.

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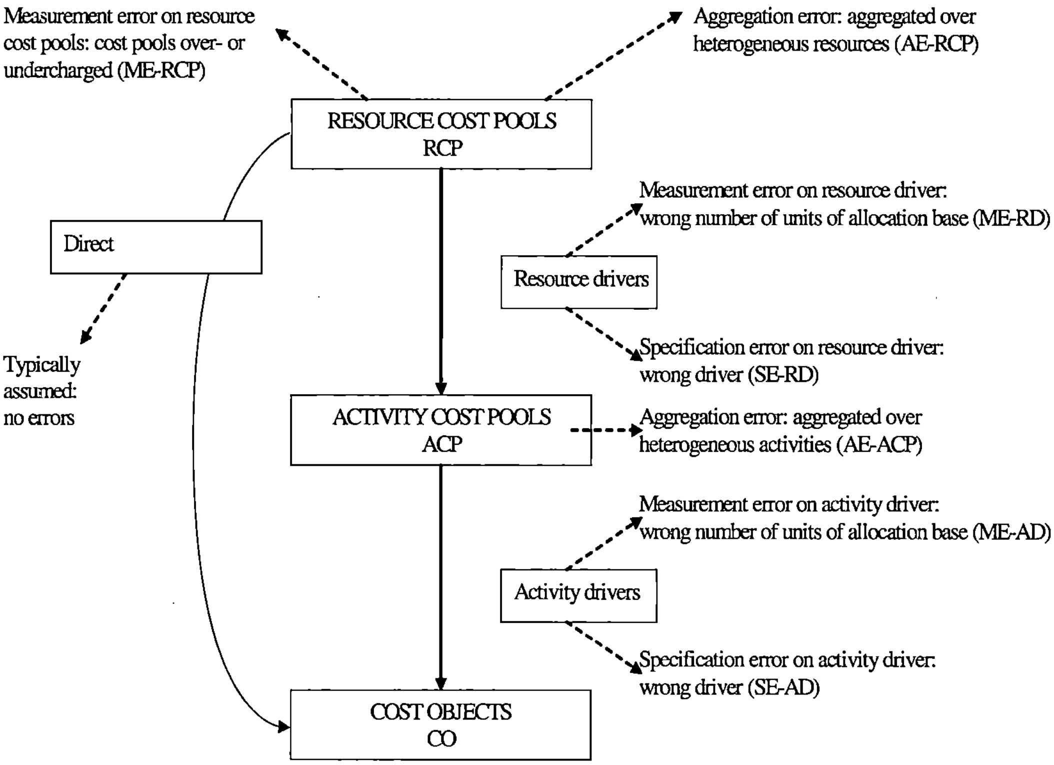
[1] While not common (Balakrishnan and Sivaramakrishnan 2002), simulations are nonetheless an integral part of the management accounting literature. See, e.g., Balachandran et al. (1997), Balakrishnan and Sivaramakrishnan (2001), Banker and Hansen (2002), Christensen and Demski (1997), Dhavale (2005), Lambert and Larcker (1989), and Leitch et al. (2005).

II. ERRORS IN THE DESIGN OF COSTING SYSTEMS

Because a costing system is a model of an unobservable true cost, reported product costs likely contain biases and errors. We rely on Datar and Gupta (1994) for definitions of the errors stemming from the design of costing systems.[2] As in Hwang et al. (1993), we assume that direct costs are measured without error for every cost object, and hence exclude them from the analysis. Figure 1 summarizes the errors under study, which consist of aggregation, measurement, and specification errors.[3]

Aggregation error can occur at two different points in the costing system. Prior studies (e.g., Noreen 1991; Babad and Balachandran 1993; Datar and Gupta 1994) typically define aggregation error at the *activity cost pool* (AE-ACP) level, connecting the first and second stage of the costing system. For example, one setup activity is incorrectly defined when an

FIGURE 1
Errors in Costing System Design


Measurement error on resource cost pools: cost pools over- or undercharged (ME-RCP)
Aggregation error: aggregated over heterogeneous resources (AE-RCP)
RESOURCE COST POOLS
RCP
Direct
Typically assumed: no errors
Measurement error on resource driver: wrong number of units of allocation base (ME-RD)
Resource drivers
Specification error on resource driver: wrong driver (SE-RD)
ACTIVITY COST POOLS
ACP
Aggregation error: aggregated over heterogeneous activities (AE-ACP)
Measurement error on activity driver: wrong number of units of allocation base (ME-AD)
Activity drivers
Specification error on activity driver: wrong driver (SE-AD)
COST OBJECTS
CO

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[2] Note that we do not study costing errors that follow from jointness or nonlinearity (Noreen 1991). These errors are also excluded in the analysis of Datar and Gupta (1994).

[3] Although we will use the ABC terminology throughout the whole paper, the results are generalizable to any conventional two-stage overhead cost allocation system.

expensive engineering setup and a cheaper labor setup are pooled in an activity cost pool, because these are heterogeneous activities. In this paper, we recognize that aggregation error can also occur at the first stage of the system, when heterogeneous resources are aggregated in the same *resource cost pool* (AE-RCP). For example, rent and supervision costs are pooled in one resource cost pool called "administration costs."

Measurement error can occur at three different points in the costing system. First, a particular *resource cost pool* (ME-RCP) might be over- or undercharged. For example, when the accountant accidentally records the cost of a marketing campaign within the administrative expenses resource cost pool, the administrative cost pool will be overcharged and the marketing cost pool will be undercharged. As in Datar and Gupta (1994, 583) we assume that the sum of the measurement errors over all resource cost pools is zero, because the firm knows its total costs.[4] In other words, measurement error in the resource cost pool is entirely caused by misclassifications.

Second, there can be measurement error in the *resource driver* (ME-RD) when an incorrect estimate is used as the basis for the allocation. For example, time is often used as a resource driver (e.g., Cooper and Kaplan 1998; Kaplan and Atkinson 1998; Narayanan and Sarkar 2003). Errors can arise when an administrative assistant inaccurately estimates the time spent on handling invoices and this estimate is used to allocate administrative salaries among activities. Third, measurement error can also arise at the level of *activity drivers* (ME-AD) when, for example, a cost object is estimated to consume ten incoming inspections when it consumes only eight.

Finally, *specification error* can arise in both the resource driver (SE-RD) and the activity driver (SE-AD). According to Datar and Gupta (1994, 568), "Specification error arises when the method used to identify costs to products does not reflect the demands placed on resources by individual products." Datar and Gupta's (1994) example refers to selection of the wrong cost driver unit, as when overhead is allocated using direct labor hours instead of the number of setups.

Commonalities among Errors

While each source of error (aggregation, specification, and measurement) is conceptually distinct, it can be difficult to distinguish among them empirically. Consistent with Babad and Balachandran (1993, 565), our analysis uses the relative frequency (or volume of use) of a cost driver associated with a cost object or process instead of the absolute. Empirically, then, specification error as defined by Datar and Gupta (1994) is similar to measurement error in the cost driver, and results in the wrong percentage of the resource being allocated to the activity (in a first-stage example). For example, when we assign supervision costs to the activity "stamping" on the basis of the square feet occupied by the stamping machine on the production floor rather than on the (more plausible) basis of time spent by the supervisor overseeing the stamping process, the effect will be the same as if the amount of time spent by the supervisor overseeing stamping was wrongly measured or estimated. In both cases, the percentage allocated is wrong. Therefore, in our simulation we use only one construct to model both specification and measurement error in the cost driver.[5]

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[4] This means that overcharging and undercharging will cancel out over all resource cost pools. This assumption allows us to compare our simulation results across different settings.

[5] Keys and Norton (1978) list errors caused by incorrect specification of the variable to be measured as one of three ways in which measurement error can occur. Of course, it remains important to continue differentiating between the two types of errors as they have different causes in real-world applications (incorrect drivers and measurement problems with units of allocation bases, respectively) and will therefore require different treatment.

Interactions among Errors

Errors in reported product costs are a function of the complex interactions among the sources of errors outlined above. Datar and Gupta (1994) show that there can be offsetting effects between aggregation and specification errors. An improvement in the specification of the cost drivers may thus result in *decreased* overall accuracy in the presence of aggregation error because of the loss of offsetting effects between these errors (and vice versa). Datar and Gupta (1994) also argue that there can be a trade-off between aggregation and measurement error. When aggregation error is decreased by the definition of a larger number of activities, measurement error in time estimates may increase with such increased number of activities the estimator must assess in terms of time consumption. Christensen and Demski (1995) make the related point that the use of multiple cost pools (i.e., less aggregation) may not necessarily lead to more accurate product costs, as measurement error may increase.

Measuring the Overall Error in the Costing System

The introduction of aggregation, specification, and measurement errors into a costing system will result in inaccurate costing of cost objects. Following Babad and Balachandran (1993), Hwang et al. (1993), and Homburg (2001), we use the following measure of overall error in the costing system:

$$\mathrm{EUCD} = \sqrt{\sum_{k=1}^{CO} (tc_k - fc_k)^2} \quad (1)$$

with k indexing the number of cost objects $(1,..,CO)$, tc_k representing the true cost accruing to cost object k in the true benchmark scenario, and fc_k representing (false) costs allocated to cost object k by the costing system approximation. We draw attention to two features of Equation (1). First, we can interpret this measure in dollar terms. Second, the measure is symmetric, reflecting our lack of knowledge about the relative economic consequences of errors that under- or over-cost a product.

Before proceeding, we emphasize that our study does not promote accuracy for the sake of accuracy. Decisions about error tolerance and accuracy levels depend on the specific use of the cost system. In most organizations, costing systems serve many different needs, such as product costing, pricing, product mix decisions, capacity planning, capacity allocation, control, performance measurement, benchmarking, and project selection. These diverse objectives may require different levels of accuracy (or bias), which is outside the scope of our study. Different *measures* of accuracy may also be important in different contexts faced by firms. We include a variety of error measures as the dependent variable in our simulation experiments and report robustness results in Appendix A.

III. SIMULATION EXPERIMENTS

In this section, we briefly describe the main aspects of the simulation.[6] We simulate a wide variety of true costing systems to cover the range of potential true cost benchmarks. For each benchmark costing system, we simulate a wide variety of (false) costing system approximations, by varying several aggregation and measurement errors that could arise in developing and implementing the costing system.

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[6] The simulation is coded in Visual C++ version 6.0 under Windows XP.

The number of resource cost pools (RCP), activity cost pools (ACP), and cost objects (CO) determine the overall design of a two-stage costing system.[7] We use the subscript t to denote the true values of RCP, ACP, and CO. As in Datar and Gupta (1994, 571), we assume that the firm knows the cost of total resources without error. Further, we keep the value of total resources and the number of cost objects constant across all simulated costing systems to assure the comparability of our results. We randomly vary the "density" of the cost driver links in both the first and second stage of the costing system allocation (resource drivers and activity drivers, respectively), in terms of the total number of cost driver links in the system and their distribution over the various pools. We also randomly simulate the percentages of resource or activity costs allocated by each of the drivers.

Operationalizing the Error Structure

To model the presence and magnitude of aggregation and measurement errors, we introduce a disturbance factor df. This factor determines the size of different errors and, hence, measures the deviation from the true benchmark costing system in a particular respect (depending on which error is introduced). The number of settings that we introduce for each error measure is constrained by computational restrictions. Because of these restrictions we investigate the effect of two errors at a time. This limit also helps in the interpretation of any interaction results. We use ten settings for each error (df = 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, or 90%). We run simulations of all combinations of two errors in a controlled experimental design. We use real numbers and do not round them to integers or to two decimals as a costing system would do in practice.[8]

For each result, we simulate 500 true costing systems[9] per setting for each error. Therefore, when we test the two-dimensional effect of errors (i.e., only the settings of two errors vary between 0 percent and 90 percent while all other error settings equal zero), we have 50,000 (500 × 10 × 10) different observations.

To simulate the aggregation error in resource cost pools (AE-RCP), we have to determine the number of cost pools that are added together. Consequently, we reduce the number of cost pools to $RCP^1 = (1 - df) * RCP_t$ and aggregate the costs of the original cost pools in the aggregated cost pool. The aggregation error in activity cost pools (AE-ACP) is modeled in a similar way and reduces the number of activity cost pools from the true scenario to $ACP^1 = (1 - df) * ACP_t$.

We need two steps to introduce measurement error in the resource cost pools (ME-RCP). We first determine the number of resource cost pools that are subject to error (ME1-RCP), and next determine the magnitude of the error (ME2-RCP). We use RCP^2 to denote the number of resource cost pools that are subject to the measurement error as $RCP^2 = df * RCP^1$. The magnitude of the measurement error in the resource cost pools refers to the magnitude of the deviation of the amount of resources per resource cost pool from the values in the benchmark costing system.

We follow a similar two-step process to introduce measurement error in the resource drivers (ME-RD) and activity drivers (ME-AD). We first determine the number of resource cost pools $RCP^3 = df * RCP^1$ whose resource drivers are subject to measurement error.

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[7] We simulate costing systems with an egg-timer shape: many resource cost pools provide resources to fewer activity cost pools that are used on many cost objects (RCP = CO > ACP). Appendix A reports on the robustness checks carried out for alternative costing system design shapes.

[8] The additional errors that rounding would create would distort our results, since those rounding errors would falsely be attributed to errors in the design of the costing system.

[9] This creates 500 true benchmarks where the density of cost driver links and the percentages allocated by those links are randomly varied.

Next, for each resource cost pool in the set RCP^3, we randomly change the percentages of the resources allocated by each resource driver. Accordingly, we are using an incorrect percentage to allocate the resources to the activities. We apply an identical method to model measurement error in the activity drivers (ME-AD). Appendix B provides a specific example of a benchmark costing system and how we introduce aggregation and measurement errors into this system.

Data Analysis Methodology

For each set of simulated data we perform ANOVA analyses and report R^2, F-values, and significance levels. Given our large sample sizes (typically 50,000 observations per data set), even small effects become significant at very high levels. Therefore, we also report partial η^2 values that measure the proportion of total variability attributable to a factor, and therefore the relative effect size. Further, to allow us to sign the main and interaction effects, we run regressions of the form:

$$\mathrm{EUCD} = \mathrm{a} + \mathrm{b}(X_1 - \bar{X}_1) + \mathrm{c}(X_2 - \bar{X}_2) + \mathrm{d}(X_1 - \bar{X}_1)(X_2 - \bar{X}_2) + u \qquad (2)$$

where X_1 and X_2 are the two errors analyzed. These independent variables in the regressions are centered on their respective means to remove multicollinearity and to scale the interaction effect (Aiken and West 1993).[10]

IV. PARTIAL REFINEMENT USUALLY INCREASES ACCURACY

Detailed costing systems, such as ABC, aim to increase accuracy by reducing specification and aggregation error. ABC proponents advocate choosing cost drivers that reflect the cause-and-effect relationships, and using more cost pools to increase homogeneity within a pool. Cooper and Kaplan (1988b) further argue that such refinements can be done gradually, focusing on partial improvements. Cooper and Kaplan (1998) stress focusing on refinements in areas with large costs in indirect and support resources and in areas where there is wide variety in products, customers, and processes. From a behavioral point of view, a gradual refinement may alleviate resistance to change. The focus of a partial refinement can be on the more cooperative departments of a company. In addition, fewer resources are required with a partial overhaul. Redesigning the entire costing system may be infeasible because of the extent of the measurement exercise (Cooper et al. 1992).

Datar and Gupta (1994), however, have indicated that gradual refinement may not lead to more accurate costing. Through a series of examples they show that partially improving the specification of cost drivers and disaggregating cost pools can actually increase the total error in the costing system in cases when errors in the old costing system were (partially) offsetting. Gupta (1993) finds that negative covariation in errors is common when the manufacturing process uses both labor and machine-intensive technologies.[11]

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[10] Because X_1 and X_2 are simulated to be uncorrelated, the mean of the cross product term of their z-scores will also be zero and therefore be itself standardized. As a result, the regression analysis used here is appropriate (Friedrich 1982).

[11] Gupta (1993, 202) documents at one of his field sites that for more than 50 percent of products, 80 percent or more of the differences in activity costs allocated at the aggregate level offset each other. Datar and Gupta (1994) also acknowledge that reducing aggregation (and specification) error may increase measurement errors and therefore result in lower accuracy of cost objects. This happens when the firm measures overheads and units of allocation base at the aggregate cost pool fairly accurately, but significant error is introduced in measuring overhead and units of allocation base at the disaggregate cost pools. Cardinaels and Labro (2006) find empirical support for the assumption that the use of an allocation base is measured more accurately at aggregate cost pool level than at disaggregate cost pool level in a laboratory experiment where measurement error is endogenously determined.

Results

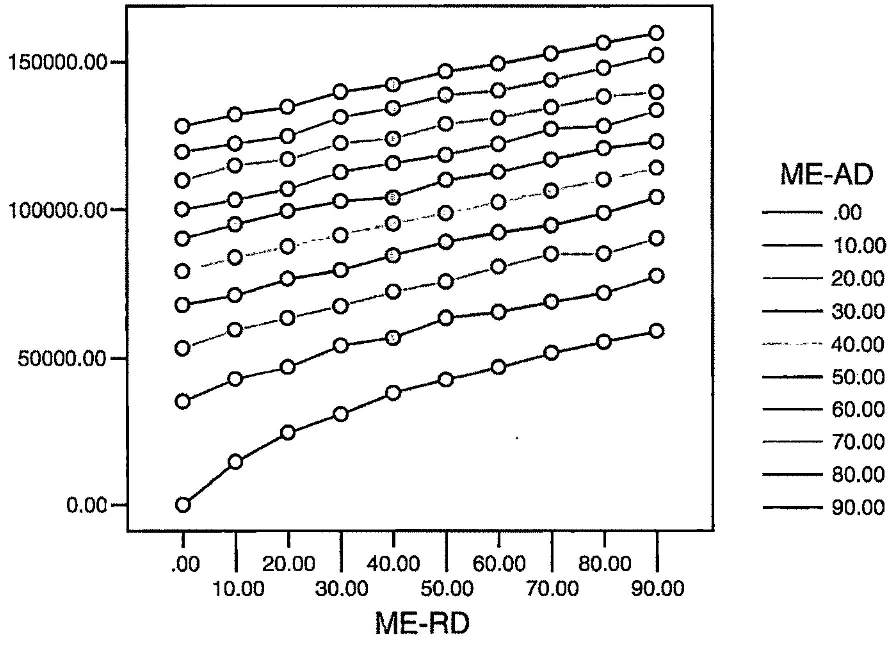
Despite the concerns raised above, our results suggest that *a partial refinement of aggregation and measurement errors generally tends to increase the accuracy of reported product costs.* Table 1 summarizes results for the interaction of measurement error in the resource driver and in the activity driver. As noted earlier, measurement error in the cost driver in our setting also reflects specification error. We could therefore also interpret these

TABLE 1
Analysis of the Measurement Error in the Resource Driver – Measurement Error in the Activity Driver Effects[a]

Panel A: Analysis of the EUCD Error Measure

Source of Variation	F	Sig.	Partial η^2	Standardized Regression[b] Coefficient β	t-value
ME-RD	908	0.000*	0.141	0.255	88.81
ME-AD	7392	0.000*	0.571	0.722	252
ME-RD*ME-AD	4.903	0.000*	0.008	−0.037	−13.04
R^2	0.601			0.588	

Panel B: Marginal Estimated Means Plot of EUCD



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* Indicates significance at the 1 percent level.

[a] EUCD = square root of mean squared error; ME-RD = measurement error in resource drivers; and ME-AD = measurement error in activity drivers. Note that, as explained in Section II, measurement error in the cost driver can also be interpreted as specification error in this empirical setting.

[b] The independent variables in the regression are mean-centered to remove multicollinearity and to scale the interaction term.

results as the interaction between specification error and measurement error in the driver. This table is representative of our results for all other combinations of two errors (other than the exceptions reported below).[12]

The marginal estimated means plot in Table 1 suggests that partial refinement of one error always improves accuracy. First, when moving to less measurement error in the resource driver (ME-RD) (e.g., from a setting of 50 percent to 40 percent), EUCD decreases. Moving to less measurement error in the activity driver (ME-AD) also decreases EUCD. Further, the ANOVA and regression analysis show that there are strong main effects of both ME-RD and ME-AD, reducing overall accuracy. The ANOVA suggests a very weak negative interaction effect, but as its partial η^2 is negligible, this is most likely solely driven by the large sample size effect.

Exceptions

There are at least three exceptions to this general rule. In these cases, a partial improvement in one error does *not* lead to an overall improvement in accuracy. First, Table 2 shows an important offsetting effect between aggregation error in the activity cost pool (AE-ACP) and measurement error in the resource driver (ME-RD). Note that these are errors in two different stages of the costing system and that AE-ACP links the first stage to the second stage. For levels of measurement error of 50 percent or greater in the resource driver, we observe an offsetting effect between ME-RD and AE-ACP in the marginal estimated means plot. When measurement error in the resource driver is above 50 percent, increasing aggregation error in the activity cost pool *improves* overall accuracy. This effect is even stronger for very high levels of measurement error in the resource driver.

Also, the partial η^2 for AE-ACP in Panel A of Table 2 is very low, which indicates that an effect reversal may be taking place. Further analysis of the correlation coefficients between independent and dependent variables in subsamples in Panel C shows that this is indeed the case. For the subsample with low ME-RD ($<=$ 40%), we find that increasing AE-ACP increases EUCD, whereas this effect becomes negative for the subsample with high ME-RD ($>=$ 50%). Intuitively, when more resource cost pools have measurement error in their resource drivers, there is greater potential for offsetting of the errors when the activity cost pools are aggregated. The aggregation process between Stage I and Stage II will offset the measurement error introduced in Stage I. Disaggregating activity cost pools when measurement error in the resource drivers is high ($>$ 50) is thus likely to have adverse consequences for the overall accuracy of the costing system.

Second, a similar trade-off occurs when the aggregation and measurement error in the outgoing cost driver pertain to the same stage of the cost allocation. The marginal estimated means plot in Table 3 shows a negative interaction effect when aggregation error in the activity cost pool (AE-ACP) is very high ($>=$ 70%) and measurement error in the activity driver (ME-AD) is low ($<=$ 20%). Panel C shows that for the subsample with very high AE-ACP and low ME-AD, the correlation between AE-ACP and EUCD is negative, whereas for the remainder of the sample the correlation between AE-ACP and EUCD is positive. Untabulated results show that a similar relation holds for aggregation and measurement errors in the outgoing cost driver in Stage I. Intuitively, if aggregation error is very high, then few cost pools remain in the costing system. Measurement error in a small

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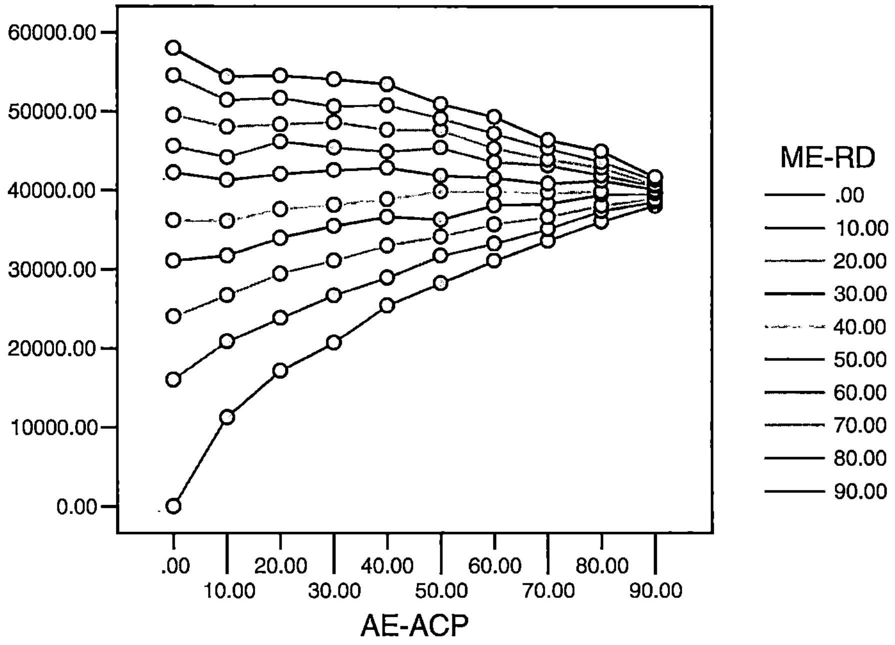
[12] The marginal estimated means plots for untabulated effects are available from the authors on request and ANOVA and regression results for most other combinations are summarized later in Table 5.

TABLE 2
Analysis of the Aggregation Error in the Activity Cost Pools – Measurement Error in the Resource Drivers Effects

Panel A: Analysis of the EUCD Error Measure for the Full Sample[a]

Source of Variation	F	Sig.	Partial η^2	Standardized Regression[b] Coefficient β	t-value
AE-ACP	20.6	0.000*	0.004	0.047	11.131
ME-RD	511	0.000*	0.084	0.284	67.145
AE-ACP*ME-RD	19.6	0.000*	0.031	−0.161	−38.143
R^2	0.113			0.109	

Panel B: Marginal Estimated Means Plot of EUCD



Panel C: Correlation Analysis for the Split Samples

Pearson[c] Correlation of EUCD with:	Subsample with ME-RD <= 40	Subsample with ME-RD >= 50
AE-ACP	0.213 (0.000*)	−0.085 (0.000*)
ME-RD	0.202 (0.000*)	0.105 (0.000*)

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* Indicates significance at the 1 percent level.

[a] EUCD = square root of mean squared error; ME-RD = measurement error in resource drivers; and AE-ACP = aggregation error in the activity cost pools.

[b] The independent variables in the regression are mean-centered to remove multicollinearity and to scale the interaction term.

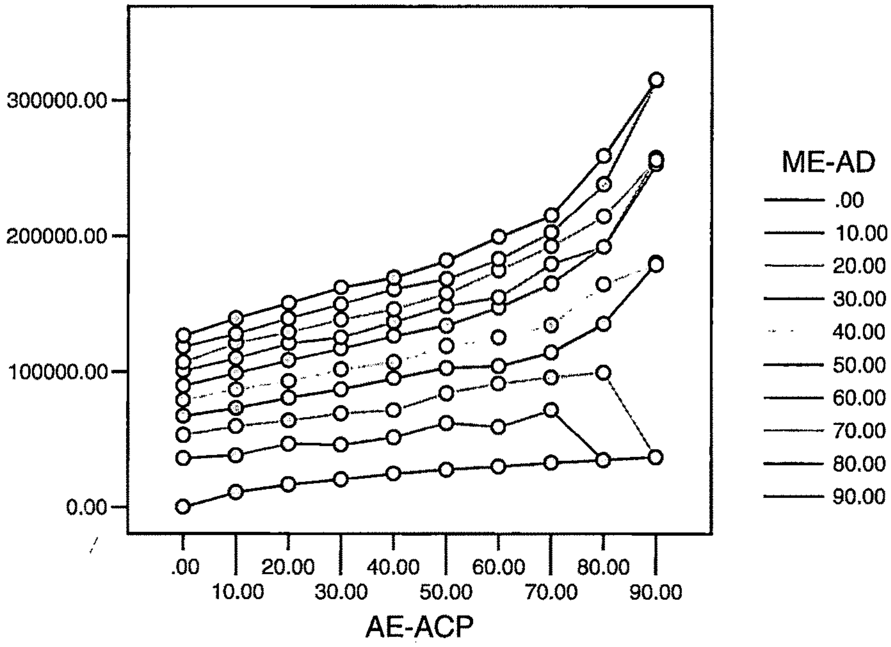
[c] Spearman correlations are consistent with these.

TABLE 3
Analysis of the Aggregation Error in Activity Cost Pools – Measurement Error in Activity Driver Effects

Panel A: Analysis of the EUCD Error Measure for the Full Sample[a]

Source of Variation	F	Sig.	Partial η^2	Standardized Regression[b] Coefficient β	t-value
AE-ACP	6337	0.000*	0.533	0.426	197
ME-AD	18105	0.000*	0.766	0.731	339
AE-ACP*ME-AD	324	0.000*	0.345	0.225	104
R^2	0.832			0.767	

Panel B: Marginal Estimated Means Plot of EUCD



Panel C: Correlation Analysis for the Split Samples

Pearson[c] Correlation of EUCD with:	Subsample with ME-AD <= 20 and AE-ACP >= 70	Subsample with ME-AD >= 30 and AE-ACP <= 60
AE-ACP	−0.321 (0.000*)	0.446 (0.000*)
ME-AD	0.461 (0.000*)	0.579 (0.000*)

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* Indicates significance at the 1 percent level.

[a] EUCD = square root of mean squared error; ME-AD = measurement error in activity drivers; and AE-ACP = aggregation error in the activity cost pools.

[b] The independent variables in the regression are mean-centered to remove multicollinearity and to scale the interaction term.

[c] Spearman correlations are consistent with these.

number of the outgoing cost drivers will therefore have little impact. Consequently, disaggregating cost pools is likely to have an adverse effect on overall accuracy in this case.[13]

Finally, the marginal estimated means plot in Table 4 suggest that high aggregation error in resource cost pools in Stage I offsets measurement error in resource cost pools when nearly all resource cost pools are measured with very high measurement error (ME1-RCP = 90% and ME2-RCP > 70%) and aggregation error is very high (AE-RCP > 80%). However, a more detailed study of the subsamples reveals that in the subsample with high aggregation and measurement error in the resource cost pools, all correlations with EUCD become insignificant, even though the correlation between AE-RCP and EUCD appears negative.

V. STAGE II VERSUS STAGE I ERRORS

Previous literature has typically focused on the second stage of the allocation mechanism (e.g., Datar and Gupta 1994; Babad and Balachandran 1993). We explicitly introduce the first stage of the costing system and the errors that can occur there. Stage I errors are measurement error in the resource cost pools, aggregation error in the resource cost pools, and measurement error in the resource drivers. Stage II errors then are aggregation error in the activity cost pools and measurement error in the activity drivers. We run analyses for every combination of Stage I and Stage II errors. Some of these results are reported earlier in Tables 1 through 4. For the remaining combinations of two errors not tabulated earlier, we report ANOVA and regression results in Table 5. Panel A presents combinations of errors in both stages, Panel B examines combinations of errors in Stage I.

Panel A of Table 5 shows that the impact of Stage II errors on overall accuracy is always significantly greater than the impact of Stage I errors, with one exception.[14] F- and partial η^2-values are larger for Stage II errors than for Stage I errors. Higher levels of EUCD are reached when Stage II errors are introduced. The R^2 of models with Stage I errors are usually lower than those that have both Stage I and Stage II errors. The highest R^2 and EUCD levels are achieved for the model with two Stage II errors (Table 3). This suggests that other factors that are not included in the ANOVA analyses must play a more important role in the models with only Stage I errors or Stage I and Stage II errors.

Intuitively, an error in Stage I is likely to be offset by allocations in Stage II, reducing its impact. Allocations in Stage II thus have a dampening effect on the error introduced in Stage I. Gokins (2001, and in personal communication) elaborates on a similar intuition from his practical experience with ABC implementations, but observes that most practitioners think that there is a compounding, rather than dampening, effect of the second stage.

Our findings suggest that partial costing system improvement should focus on reducing errors in Stage II before dealing with errors in Stage I. The underlying intuition is that

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[13] This effect is even more pronounced for a percent error metric $\left(MPE = \frac{1}{CO}\sum_{k=1}^{CO}\frac{|tc_k - fc_k|}{tc_k}\right)$ (Christensen and Demski 1997) where the offsetting effect plays from high levels of aggregation error (60 to 90 percent) to medium levels of measurement error (up to 40 percent).

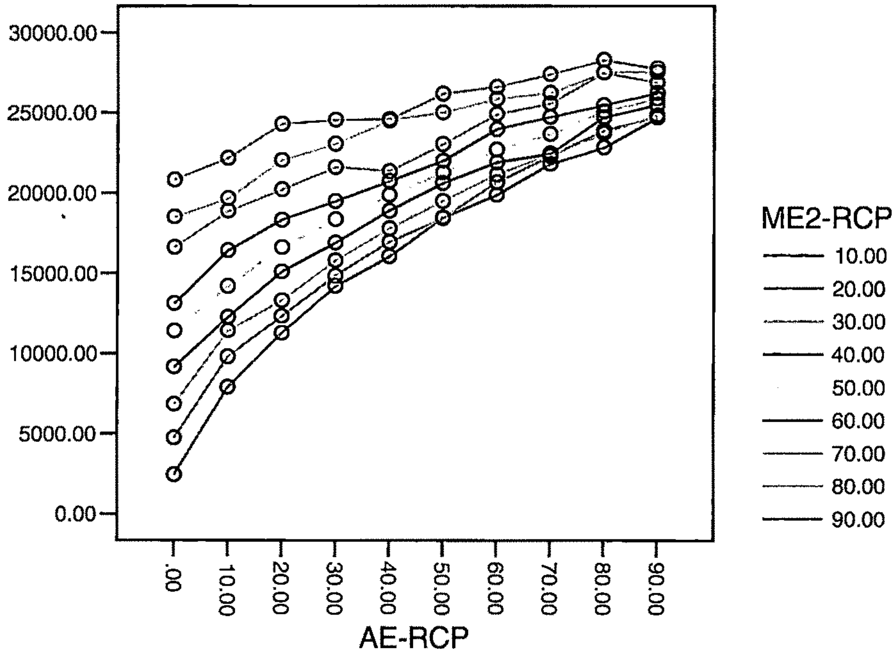
[14] Note that Datar and Gupta's (1994) Propositions 2 and 3 may lead us to examine the differential impact of the different measurement errors and the impact that aggregation error has on this differential impact. We cannot directly test the frequency of occurrence of the effects explained in their propositions, since they are based on assumptions about the effect of disaggregation on other variables that we do not model in our simulation. For example, they explain how the process of disaggregation is likely to cause the variance in the products' relative resource usages at the aggregate cost pool to be less than the variance in the products' relative resource usages at the disaggregate cost pools. Hence, the precise approach aimed at reducing aggregation error will lead to increasing measurement error in the overhead costs. Our simulation, however, randomly determines which cost pools are aggregated and therefore also randomly determines the resource consumption patterns at these cost pools.

TABLE 4
Analysis of the Aggregation Error in Resource Cost Pools
– Size of Measurement Error in Resource Cost Pools Effects when a Very High Number of Resource Cost Pools is Subject to Measurement Error

Panel A: Analysis of the EUCD Error Measure for the Full Sample[a]

Source of Variation	F	Sig.	Partial η^2	Standardized Regression[b] Coefficient β	t-value
AE-RCP	208	0.000*	0.040	0.195	42.55
ME2-RCP	108	0.000*	0.019	0.134	29.26
AE-RCP*ME2-RCP	2.67	0.000*	0.004	−0.060	−13.17
R^2	0.061			0.059	

Panel B: Marginal Estimated Means Plot of EUCD



Panel C: Correlation Analysis for the Split Samples

Pearson[c] Correlation of EUCD with:	Subsample with ME2-RCP <= 60 and AE-RCP <= 70	Subsample with ME2-RCP >= 70 and AE-RCP >= 80
AE-RCP	0.240 (0.000*)	−0.007 (0.719)
ME2-RCP	0.102 (0.000*)	0.012 (0.511)

---

* Indicates significance at the 1 percent level.

[a] EUCD = square root of mean squared error; ME2-RCP = size of measurement error in resource cost pools; ME1-RCP = number of resource cost pools subject to measurement error; and AE-RCP = aggregation error in the activity cost pools. ME1-RCP = 90 for the analyses in this table.

[b] The independent variables in the regression are mean-centered to remove multicollinearity and to scale the interaction term.

[c] Spearman correlations are consistent with these.

TABLE 5
Impact of Stage I and Stage II Errors[a]

Model	Source of Variation	F	Sig.	Partial η^2	Standardized Regression[b] Coefficient β	t-value
Panel A: Analysis of EUCD Error Measure for Remaining Combinations of Stage I and II Errors						
1	AE-RCP	16.89	0.000*	0.003	0.029	11.11
	ME-AD	11653	0.000*	0.678	0.808	308
	AE-RCP*ME-AD	7.2	0.000*	0.012	−0.053	−20.11
	R^2	0.679			0.657	
2	AE-RCP	61.98	0.000*	0.011	0.1	23.37
	AE-ACP	453	0.000*	0.075	0.27	63.12
	AE-RCP*AE-ACP	4.747	0.000*	0.008	−0.076	−17.74
	R^2	0.091			0.088	
3[c]	ME2-RCP	46	0.000*	0.008	0.084	18.99
	AE-ACP	569	0.000*	0.102	0.314	70.60
	ME2-RCP*AE-ACP	3.706	0.000*	0.006	−0.067	−15.06
	R^2	0.113			0.110	
4[d]	ME1-RCP	52	0.000*	0.009	0.090	21.97
	AE-ACP	648	0.000*	0.105	0.317	75.17
	ME1-RCP*AE-ACP	4.228	0.000*	0.007	−0.069	−16.41
	R^2	0.117			0.113	
5[c]	ME2-RCP	66	0.000*	0.012	0.064	22.01
	ME-AD	8968	0.000*	0.642	0.786	270
	ME2-RCP*ME-AD	1.471	0.006*	0.002	−0.016	−5.56
	R^2	0.644			0.621	
6[d]	ME1-RCP	61	0.000*	0.011	0.063	22.58
	ME-AD	9499	0.000*	0.631	0.779	279
	ME1-RCP*ME-AD	1.900	0.000*	0.003	−0.019	−6.85
	R^2	0.633			0.611	
Panel B: Analysis of EUCD Error Measure for Remaining Combinations of Errors in Stage I						
7	AE-RCP	537	0.000*	0.088	0.262	67.12
	ME-RD	1257	0.000*	0.185	0.406	104
	AE-RCP*ME-RD	9.52	0.000*	0.015	0.078	19.88
	R^2	0.253			0.240	
8[d]	AE-RCP	215	0.000*	0.037	0.187	43.09
	ME1-RCP	137	0.000*	0.024	0.151	34.95
	AE-RCP*ME1-RCP	3.29	0.000*	0.005	−0.063	−14.48
	R^2	0.064			0.062	

---

* Indicates significance at the 1 percent level.

[a] Stage I errors are: AE-RCP = aggregation error in the resource cost pools; ME-AD = measurement error in the activity drivers; ME1-RCP = number of resource cost pools subject to measurement error; and ME2-RCP = size of measurement error in resource cost pools. Stage II errors are: AE-ACP = aggregation error in activity cost pools; ME-AD = measurement error in activity drivers.

[b] The independent variables in the regression are mean-centered to remove multicollinearity and to scale the interaction term.

[c] ME1-RCP is set at 90 percent to bias the sample against finding our result that Stage II errors have more impact.

[d] ME2-RCP is set at 90 percent to bias the sample against finding our result that Stage II errors have more impact.

there is limited value to reducing Stage I errors as long as Stage II errors that have a more severe impact on overall accuracy are likely to be present. The error with the least impact is measurement error in the resource cost pools (ME-RCP). Gokins (2001) argues, however, that accountants will work to ensure that there is little measurement error in the resource cost pools, given their familiarity with and focus on general ledger expense data. He questions whether this focus may be misplaced. Our results confirm his intuition.

While this provides a simple and easy-to-implement decision rule for costing system improvements, there are noteworthy exceptions. The key exception to the above rule is the case of aggregation error in the activity cost pools (AE-ACP), linking Stage I into Stage II. Table 2 shows that the impact of AE-ACP is smaller in terms of F and η^2 than the impact of the first-stage measurement error in the resource driver (ME-RD). This is due to the effect reversal of AE-ACP in the two subsamples for high and low ME-RD as discussed earlier, which is likely to result in an insignificant main effect for AE-ACP in the overall sample (or, in our large-sample case, little impact in terms of partial η^2). Panel C of Table 2 shows that the impact of AE-ACP is stronger in the subsamples that are split based on ME-RD values.

VI. BIAS CAUSED BY COSTING ERRORS

Hwang et al. (1993, 222) show how distortions in product costs are weighed by the product mix ratio, which measures each product's share of production in terms of the percentage of inputs it consumes. If some products are considerably more important in the product mix than others, we may expect more errors in product costs. Gupta (1993, 203) argues that the probability of larger costing errors is higher for products to which more costs are allocated. He finds positive correlations in two case firms between the cost of the products and his absolute error measure.[15] For a percentage error measure, he finds evidence of the effect in only one of the two firms.

We look at the role of the value of the cost objects (in dollar terms) from the perspective of the accuracy of the *set of cost objects as a whole*. Specifically, we calculate the following measure of the variance in the dollar magnitude of the cost objects in the benchmark scenario:

$$VARSIZE = \frac{\sum_{k=1}^{CO} |tc_k - \overline{tc}|}{\max_{k=1}^{CO} |tc_k - \overline{tc}|}. \tag{3}$$

The numerator of this measure is the sum of the absolute differences between the dollar size of the cost object and the mean dollar size across all cost objects in the true system. We normalize this by scaling by the maximum absolute difference so that the value of *VARSIZE* always lies between 0 and 1. Accordingly, if *VARSIZE* is close to 0, then all products are more or less equally important in the product mix of the benchmark scenario. If *VARSIZE* is closer to 1, then some products make up a very important part of the product mix, while others are almost negligible (i.e., some are very important in the product mix in terms of dollar volume, while others are relatively unimportant). We randomly simulate 10,000 observations for the various aggregation, specification, and measurement errors and calculate Spearman rank correlations between *VARSIZE* and the resulting error measures EUCD and MPE, where MPE is a percent error metric defined as $\frac{1}{CO}\sum_{k=1}^{CO}\frac{|tc_k - fc_k|}{tc_k}$.

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[15] Cooper (1990) and Gupta (1993, 183, 205) make similar observations on activity level: activities with high costs are associated with higher levels of error.

We find that a larger variance in the dollar size of the cost objects in a product portfolio will decrease the accuracy of the costing system. The Spearman rank correlation coefficient for (*VARSIZE*, EUCD) is positive (0.182, $p < 0.01$). We are particularly interested in our MPE error metric, as this controls for the cost of a cost object. We find a strong positive correlation with *VARSIZE* of 0.43 ($p < 0.01$), suggesting that our result is not solely driven by the costs of cost objects but also by the variance in the magnitude of these costs across the whole costing system.[16]

Because we find strong evidence that such variance in the dollar size of cost objects leads to greater sensitivity to costing errors, we can also determine where over- and under-costing biases are introduced in the product portfolio (Christensen and Demski 1997). Gupta (1993, 196) finds that relatively more products are under-costed than over-costed in his two case study firms. We compare *AB*, which measures the percentage of cost objects that are materially *over-costed*, with *BE*, which measures the percentage of cost objects that are materially *under-costed*. In mathematical notation,

$$AB = \frac{1}{CO}\sum_{k=1}^{CO}\{1|fc_k > 1.05 * tc_k;\ 0 \text{ otherwise}\} \tag{4}$$

$$BE = \frac{1}{CO}\sum_{k=1}^{CO}\{1|fc_k < 0.95 * tc_k;\ 0 \text{ otherwise}\} \tag{5}$$

where immaterial costing errors lie within a 10 percent symmetric interval around the true cost benchmark, following the ABC literature (Kaplan and Atkinson 1998, 111).

Table 6 reports the analysis of means and medians of *BE* minus *AB* for those models where the R^2 of the ANOVA model on *BE* minus *AB* is greater than 10% percent. The table shows that the percentage of under-costed cost objects is usually larger than the percentage of over-costed cost objects (i.e., *BE* minus *AB* is usually greater than zero).[17] Since we keep total resources constant for comparability reasons, the *amount* of downward bias has to equal the amount of upward bias.[18] This means that the average amount of over-costing per product exceeds the average amount of under-costing per product. Recall our earlier finding of increased sensitivity to error in costing systems when the product mix contains some products that are much more valuable than others. Combining these two results we infer that the large upward biases are occurring mostly on the expensive (large dollar magnitude) products, with small downward biases occurring on the inexpensive (small dollar magnitude) products.

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[16] However, higher variance in magnitude of cost objects goes hand in hand with the presence of more costly (and also less costly) cost objects.

[17] Again, the only exception is in the model with AE-ACP and MERD where there is little bias.

[18] Note that Christensen and Demski (1997) also report results on bias. They define bias with respect to the marginal cost of each product and show that an ABC procedure can offer consistent underestimation for particular underlying technologies. (Their example shows this when there are diseconomies of scale in the first activity and economies of scale in the second activity.) Our definition of bias is different, and we cannot obtain consistent over- or under-estimation results, given that the total resources to be allocated remain constant both in the true benchmark and in the costing approximation.

TABLE 6
Analysis of Over- and Under-Costing Biases Due to Error:
BE minus AB < > 0[a,b]

Source of Variation	AE-ACP and ME-AD	AE-RCP and ME-AD	AE-ACP and ME-RD	ME-RD and ME-AD
Mean	0.2842	0.2039	−0.0118	0.2373
Median	0.3000	0.2200	0.0000	0.2400
Min	−0.78	−0.60	−0.82	−0.60
Max	0.96	0.84	0.86	0.88
Percentile 25	0.16	0.22	−0.08	0.14
Percentile 75	0.42	0.30	0.06	0.34
R^2 ANOVA	0.577	0.284	0.101	0.197
Confidence interval for mean	[0.2823, 0.2861]*	[0.2026, 0.2053]*	[−0.0132, −0.0105]*	[0.2360, 0.2387]*

* Indicates significance at the 1 percent level.
[a] BE = percent of cost objects materially under-costed; AB = percent of cost objects materially over-costed; $BE - AB > 0$ indicates an under-costing bias; $BE - AB < 0$ indicates an over-costing bias; AE-RCP = aggregation error in resource cost pools; AE-ACP = aggregation error in activity cost pools; ME-RD = measurement error in resource drivers; and ME-AD = measurement error in activity drivers.
[b] Only results for ANOVA models with $R^2 > 10$ percent are reported.

From a theoretical vantage point, we have no reason to expect that particular types of errors lead to over- or under-costing. We test this for the models in Table 6 by running regressions of the form:

$$BE - AB = \mathrm{a} + \mathrm{b}X_1 + \mathrm{c}X_2 + \mathrm{d}X_1X_2 + \mathrm{e}ACC + u \qquad (6)$$

where X_1 and X_2 are the two errors under consideration and ACC is defined as $\frac{1}{CO}\sum_{k=1}^{CO}$ $\{1|0.95 * tc_k < fc_k < 1.05 * tc_k;\ 0 \text{ otherwise}\}$. ACC is the percentage of cost objects that are accurately costed, allowing for a 10 percent symmetrical error.[19] Untabulated results indicate that the unstandardized regression coefficients b, c, and d are not significantly different from zero.[20] This suggests that there is no connection between the type of error and the direction of the bias when the effect of the type of error (measurement error or aggregation error) on accuracy is controlled for.

VII. CONCLUSION AND FUTURE RESEARCH

When decisions are made on the basis of reported product cost, even modest distortions in product cost may create significant distortions in decision making. While costing systems are unlikely to be error-free, we know very little about the nature and severity of these errors and the most effective ways to improve costing accuracy. We use a simulation methodology to generate a variety of potential true costing systems as well as corresponding "false" cost approximations. We present results on (1) conditions under which partial refinement in costing systems could improve overall reported cost accuracy, (2) the impact of the various types of errors on overall accuracy, and (3) the nature of the bias in product costs introduced by these types of errors.

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[19] We control for ACC in the regression since the same level of bias can be created for various degrees of accuracy. For example, a bias of BE-AB = 0.09 can be the result of BE = 0.3, AB = 0.21 (and therefore ACC = 0.49), but also of BE = 0.1, AB = 0.01 (and therefore ACC = 0.89). Without control for ACC, the coefficients on X_1, X_2 and X_1*X_2 would simply pick up their impact on the various degrees of accuracy rather than their impact on the bias of the resulting error.

[20] The standard error of these coefficients is equal to zero and coefficient intervals (with 95 percent confidence) are (virtually) points at zero.

While Datar and Gupta (1994) established that partial refinement of costing systems sometimes has adverse effects on overall accuracy, it is not clear how often and under what circumstances this occurs. Our results suggest that partial refinement of aggregation, specification, and measurement errors usually increases the accuracy of reported product costs. However, we find a number of exceptions where a partial improvement in one error does *not* lead to an overall accuracy improvement due to negative interactions between errors. Most notably, an offsetting effect occurs between aggregation error in the activity cost pool and measurement error in the resource driver.

We also identify a novel rule of thumb in costing system design: it is usually more beneficial to focus on reducing errors that occur in the second stage of the allocation process, because their impact on overall accuracy is stronger. As long as these errors are large, there is little to be gained from refining the first stage of the system, as the improvement in overall accuracy will be small at best. This is due to a dampening effect of the second stage of the allocation on errors introduced in Stage I, counter to the popular belief that Stage II errors compound Stage I errors.

Finally, we find that costing systems where all products have a more or less equal share in the product mix are most robust to errors. In situations where some products make up a very important part of total costs, while others are negligible, the sensitivity of the costing system to aggregation and measurement error is increased. We also show that introducing aggregation and measurement errors into a costing system usually results in relatively more products being under- than over-costed, but the degree of under-costing is typically small and occurs among the relatively less expensive (small dollar magnitude) products, whereas high levels of over-costing occur among the few expensive (large dollar magnitude) products.

Future research should address the implications of our results for various costing system objectives. The effect of type, size, and bias of error could be studied in specific decision contexts. For example, even without taking into account the cost of developing a more accurate costing system,[21] some research in this area has already identified combinations of situations and objectives where the designer of the costing system could introduce a particular kind of error or where an increase in accuracy is not wanted and/or needed (e.g., Merchant and Shields 1993; Banker and Potter 1993; Alles and Datar 1998; Callahan and Gabriel 1998; Mishra and Vaysman 2001; Kanodia et al. 2005).

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[21] We do not model the transaction costs of implementing more or less error-ridden costing systems as discussed in Babad and Balachandran (1993), for example. In future research that links the design of the costing system to its objective(s), such costs should be considered explicitly and weighed against the beneficial implications of costing system re-design.

APPENDIX A
ROBUSTNESS CHECKS

Various Resulting Error Metrics

Table A1 summarizes the various resulting error metrics, in addition to our main EUCD metric. Datar and Gupta (1994, 579) motivate their choice of a symmetric quadratic error metric (MSE) as a measure of the expected loss due to errors in product costs with reference to the economics-based literature where it has been shown that this loss function is valid for pricing in monopolistic and oligopolistic markets (Vives 1990; Banker and Potter 1993; Alles and Datar 1998). Hwang et al. (1993) focus their squared error measure at the cost pool level, rather than at the cost object level, and multiply this by a parameter that reflects the degree of competition in the product market. Christensen and Demski (1997) take percent errors per product and mean percent error for the whole costing system (MPE) as their dependent variables. Gupta (1993) uses both absolute and percent errors at the product level. In some contexts management may be more interested in these relative measures, since a $10 cost difference for a $10 product has different implications than a $10 cost difference for a $1,000 product. We also introduce a materiality measure (ACC). Dopuch (1993) argues that a necessary condition for potential improvements in managerial decisions from new accounting systems is that the new system generates accounting numbers that are materially different from those obtained from the existing system. ACC counts the percentage of cost objects that are materially miscosted by the costing system. Immaterial costing errors are defined as within a 10 percent symmetric interval around the true cost benchmark; 10 percent was coined as an accuracy target in the ABC literature (Kaplan and Atkinson 1998, 111).

Compared to our reported EUCD results, we usually find qualitatively similar results for ANOVA, regression analysis, and marginal estimated means plots for MAE and MSE. MSE normally has slightly lower R^2 due to the magnitudes. Very occasionally, an interaction effect becomes insignificant or significant at a different level. ACC and MPE usually yield similar results. Whenever this is not the case, it is reported in the main text. Details are available from the first author on request.

Various Costing System Designs

There is little empirical evidence on current practice in the design of costing systems (Drury and Tayles 1998) to help us choose realistic settings for our costing system design parameters (number of resource cost pools [RCP], number of activity cost pools [ACP], and number of cost objects [CO]). Therefore we run several robustness checks. First, existing evidence on the relation among RCP, ACP, and CO suggests that there are usually more cost objects than activity cost pools (see, e.g., Cooper et al. 1992, table on p. 279). Our results therefore report on costing systems with RCP = CO > ACP. We have run robustness checks for all other combinations of these three costing system design parameters for each result. We simulate 8 * 50,000 additional costing systems for each result on the interplay between two errors. ANOVAs, R^2, marginal estimated means plots, sign of interaction effects, and size of effects are all qualitatively similar. Second, our main results report on simulations with 50 cost pools, because this seems consistent with practice (Cooper et al. 1992). We run robustness checks with fewer and more cost pools for several simulations and again find qualitatively similar results.

TABLE A1
Resulting Error Measurement[a]

Measure	Description	Definition	References Where Used
EUCD	Euclidian Distance	$\sqrt{\sum_{k=1}^{CO}(tc_k - fc_k)^2}$	Babad and Balachandran (1993) Hwang et al. (1993) Homburg (2001)
MAE	Mean Absolute Error	$\frac{1}{CO}\sum_{k=1}^{CO}\lvert tc_k - fc_k\rvert$	NA
MPE	Mean Percent Error	$\frac{1}{CO}\sum_{k=1}^{CO}\frac{\lvert tc_k - fc_k\rvert}{tc_k}$	Christensen and Demski (1997)
MSE	Mean Squared Error	$\frac{1}{CO}\sum_{k=1}^{CO}(tc_k - fc_k)^2$	Datar and Gupta (1994)
ACC	Percent of accurate cost objects (10% error defined as immaterial)	$\frac{1}{CO}\sum_{k=1}^{CO}\{1 \mid 0.95 * tc_k < fc_k < 1.05 * tc_k;\ 0 \text{ otherwise}\}$	NA

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[a] CO = number of cost objects (index k);
tc_k = true cost of cost object k; and
fc_k = false cost of cost object k, as approximated by the costing system.

APPENDIX B
EXAMPLE OF SIMULATION OF COSTING SYSTEM DESIGN AND INPUT ERRORS

Table A2 shows an example of the modeling of costing systems in our simulation. Panel A of Table A2 displays the settings for the different errors for an example of a true costing system with $RCP_t = ACP_t = CO_t = 4$. Panel B of Table A2 shows the true costing system (Figure a) as well as the costing approximation after the introduction of the aggregation errors ("false" system in Figure b) and the costing approximation with all errors ("false" system in Figure c).

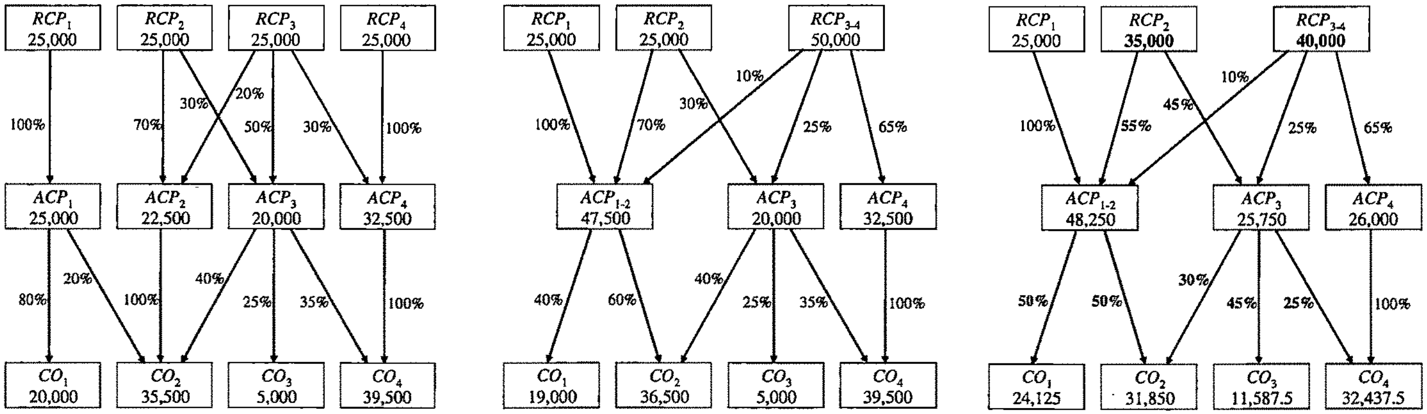
An aggregation error of 0.25 for both the resource cost pools and the activity cost pools is introduced, resulting in a costing system approximation (Figure b) where two randomly chosen resource cost pools and activity cost pools are aggregated into one (here resource cost pools 3 and 4 and activity cost pools 1 and 2), resulting in three (resource and activity) cost pools (i.e., $RCP^1 = (1 - 0.25) * RCP = 3$ and $ACP^1 = (1 - 0.25) * ACP = 3$). We additionally incorporate all types of measurement errors (with settings described in Panel A) in Figure c. The disturbance factor for the number of resource cost pools subject to measurement error equals 0.66 (ME1-RCP), with a maximal allowable deviation size of 40% for the resource cost pools subject to the error (ME2-RCP). Hence, two (of the remaining three) resource cost pools are also subject to measurement error, i.e., $RCP^2 = 0.66 * RCP^1 = 2$ (here cost pool 2 and aggregated cost pool 3–4), each of which have a "false" cost that deviates from the true cost by no more than 40 percent. The disturbance factor for the measurement error in the resource drivers equals 0.33, signifying that the resource drivers of only one resource cost pool ($RCP^3 = 0.33 * RCP^1$) are subject to this specific error. The resource drivers of this resource cost pool (in this case resource cost pool 2) are changed randomly (values 55 percent and 45 percent). The disturbance factor for the measurement error in the activity drivers equals 0.66, signifying that the activity drivers of two activity cost pools ($ACP^2 = 0.66 * ACP^1$) are subject to this error.

TABLE A2
Example of Simulating a True Costing Benchmark and a False Costing System Approximation

Panel A: Error Settings for the Example of Panel B

	Value or Formula	Used to Model Error	Settings for df
RCP^t	4	—	—
RCP^1	$= (1 - df) * RCP^t$	AE-RCP	0.25
RCP^2	$= df * RCP^1$	ME1-RCP	0.66
		ME2-RCP	0.4
RCP^3	$= df * RCP^1$	ME-RD	0.33
ACP^t	4	—	—
ACP^1	$= (1 - df) * ACP^t$	AE-ACP	0.25
ACP^2	$= df * ACP^1$	ME-AD	0.66

Panel B: Example of (a) a True Costing System, (b) a "False" Costing Approximation with Aggregation Errors and (c) a "False" Costing Approximation with Both Aggregation and Measurement Errors


(Figure a)
(Figure b)
(Figure c)

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Corporate Governance, Accounting Outcomes, and Organizational Performance

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ABSTRACT: The empirical research examining the association between typical measures of corporate governance and various accounting and economic outcomes has not produced a consistent set of results. We believe that these mixed results are partially attributable to the difficulty in generating reliable and valid measures for the complex construct that is termed "corporate governance." Using a sample of 2,106 firms and 39 structural measures of corporate governance (e.g., board characteristics, stock ownership, institutional ownership, activist stock ownership, existence of debtholders, mix of executive compensation, and anti-takeover variables), our exploratory principal component analysis suggests that there are 14 dimensions to corporate governance. We find that these indices have a mixed association with abnormal accruals, little relation to accounting restatements, but some ability to explain future operating performance and future excess stock returns.

Keywords: *corporate governance; earnings quality; firm performance; principal component analysis; recursive partitioning.*

Data Availability: *Some of the data are available from the public sources indicated in the text. Other data are a proprietary offering from commercial providers.*

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I. INTRODUCTION

Corporate governance refers to the set of mechanisms that influence the decisions made by managers when there is a separation of ownership and control. Some of these monitoring mechanisms are the board of directors, institutional shareholders, and operation of the market for corporate control. The importance of this topic is obvious from the considerable growth in the empirical literature on corporate governance across accounting, economics, finance, management, and corporate strategy literatures.[1] Typical research studies examine whether different corporate governance structures impact or constrain executive behavior and/or have an impact on organizational performance. Examples of these types of studies are Morck et al. (1988), Byrd and Hickman (1992), Brickley et al. (1994), Yermack (1996), Core et al. (1999), Klein (2002), and Gompers et al. (2003).[2]

It is difficult to conceive of a situation where corporate governance is not relevant for understanding managerial behavior and organizational performance. However, the open research question is whether the *structural* indicators that are typically used to measure corporate governance actually capture the essence of this complex construct and exhibit acceptable levels of measurement error.[3] While prior work has examined many measures of corporate governance, the results are frequently contradictory and a consistent set of empirical results has yet to emerge regarding the importance of corporate governance for understanding accounting outcomes and organizational performance.

We suspect that part of the explanation for these mixed results is that measures used in the empirical analysis exhibit a modest level of reliability and construct validity. Most studies use either a single indicator for corporate governance, or arbitrary indices. The measurement error introduced from using a single indicator (e.g., percentage of external board members) for a complex construct (e.g., board independence) will almost certainly cause the regression coefficients to be inconsistent.[4] Similar econometric problems will be produced if a set of indicators are naively summed to form some type of governance index (e.g., the "G-score" used by Gompers et al. 2003). The use of multiple indicators can alleviate the measurement error associated with a single indicator. However, unless the individual indicators are measuring the same underlying governance construct, the resulting index will be difficult to interpret and contain substantial measurement error.

Prior research also tends to use a limited sample of the dimensions of corporate governance and this will generally create correlated omitted variable problems. For example, researchers using only the "G-score" are capturing some combination of anti-takeover provisions, but ignoring other important dimensions of governance (e.g., ownership, board structure, etc.). Unless the omitted dimensions are uncorrelated with those included in the analysis (which is a very unlikely outcome), the interpretation of the regression coefficient for the "G-score" will be problematic.

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[1] There are also many organizations that sell governance ratings (e.g., GovernanceMetrics International, Institutional Shareholder Services, Investor Responsibility Center, Standard & Poors, and The Corporate Library). The growth in this type of service offerings attests to the perceived importance of corporate governance issues. Although the precise computation of these ratings is proprietary, the scores seem to be based on board independence, distribution of ownership, and other structural characteristics. Despite considerable claims by these organizations, we are not aware of rigorous evidence regarding the ability of these ratings to predict managerial behavior or organizational performance. One possible exception is Gompers et al. (2003), but the recent work by Cremers and Nair (2005) and Core et al. (2006) demonstrates that the Gompers et al. (2003) results are statistically fragile.

[2] Reviews of the extensive corporate governance literature have been provided by Shleifer and Vishny (1997), Bhagat and Black (2002), and Bushman and Smith (2001).

[3] We define *structural* indicators as measures of corporate governance that can be produced by external observers (e.g., board size, equity owned by the officers, etc.). Although infeasible for large sample analysis, it is also possible to develop measures of corporate governance from interviews with board members and a detailed assessment of governance practices from inside the organization (e.g., Leblanc and Gillies 2005; Hendry et al. 2006). For obvious reasons, most empirical research on corporate governance relies on structural indicators.

[4] It is important to note that in a multiple regression analysis the inconsistent parameter estimates caused by measurement error in the governance variables does *not* necessarily attenuate the estimates or result in conservative assessments of statistical significance (see Bollen [1989, 159–167] for a summary discussion of this issue).

The purpose of this paper is to provide an exploratory inquiry into the dimensions of corporate governance and start the process of developing reliable and valid measures for this important construct.[5] This task is especially difficult because (to our knowledge) there is not a well-developed theory about the complex, multi-dimensional nature of corporate governance or a conceptual basis for selecting the relevant governance characteristics to include in an empirical study.[6] Absent clear theory, it is difficult to specify the appropriate structural models and determine whether the relevant corporate governance constructs are included in the analysis. As a result, it is important to highlight that our analysis is inherently *exploratory* and represents an initial attempt to describe the linkages between multiple measures of governance and selected outcome variables. Subsequent research will be necessary to extend and refine these measures.

Our research is designed to assess whether the somewhat standard structural measures of corporate governance are useful in understanding managerial behavior and corporate performance. If we find unexpected relations and/or statistically insignificant results after a careful attempt to develop reliable and valid measures of governance, then this raises concerns about the use of these traditional structural measures for archival governance research. However, this result does *not* necessarily imply that corporate governance has little impact on executive behavior or organizational performance. This result may simply indicate that our ability as researchers to measure and capture the construct of corporate governance is very limited with existing structural measures.

Our measurement analysis starts with a broad sample of structural indicators of corporate governance including board characteristics, anti-takeover provisions, compensation characteristics, ownership, and capital structure characteristics. Using exploratory principal component analysis (PCA), we find that 14 factors characterize the dimensionality of our 39 individual governance indicators. This observed structure enables us to identify a set of indicators for each dimension of corporate governance and compute indices that exhibit reasonable levels of reliability and construct validity for an exploratory study.

The resulting 14 corporate governance indices exhibit a mixed association with abnormal accruals and little relation to accounting restatements. However, we find that firms with a greater proportion of blockholders, a compensation mix that is weighted toward accounting performance, lead directors, smaller boards, and fewer busy directors exhibit superior future operating performance. Further, future excess stock returns are higher when compensation mix is weighted toward accounting performance, there is a lead director, and insider power is low. Thus, the typical *structural* indicators of corporate governance used in academic research and institutional rating services have only a modest ability to explain "accounting manipulations," but exhibit some ability to explain future operating and stock price performance. The mixed ability of our governance measures to explain variation across a set of dependent variables makes broad generalizations difficult. Without a well-specified underlying structural model linking the many dimensions of governance to firm-level decision making and overall firm performance, it is difficult to make strong conclusions about the importance of corporate governance. Future research is needed to refine measures of corporate governance and develop structural models to enable a more sophisticated examination of the importance of corporate governance mechanisms.

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[5] This is an important topic for accounting because our discipline is fundamentally about measurement. While there has been considerable discussion about measuring certain constructs such as accruals (e.g., Dechow et al. 1996) and cost of capital (e.g., Easton and Monahan 2005), there has been relatively little attention devoted to the measurement of corporate governance.

[6] As discussed by Harris and Raviv (2006), there is relatively little formal theoretical work on corporate governance. Harris and Raviv (2006) and Hermalin and Weisbach (1998) provide some theoretical insights into the structure of board. However, theoretical work on the more general construct of corporate governance (to our knowledge) is unavailable.

The remainder of the paper is divided into five sections. Section II describes the sample selection and the governance indicators used in the study. Section III presents the PCA results and develops our 14 indices for corporate governance. Section IV presents the association between these governance indices and abnormal accruals, restatements, future operating performance, and future excess stock price returns. Section V provides a discussion of how our results are affected by using an alternative methodological approach (recursive partitioning), a single cross-section of data that coincides with Sarbanes-Oxley Act of 2002, and possible endogeneity of our governance constructs. A summary of the results and the conclusions are presented in Section VI.

II. SAMPLE SELECTION AND CORPORATE GOVERNANCE INDICATORS

Sample

Our sample was generated from the overlap between two comprehensive data sets. The first data set consists of the anti-takeover provisions for companies covered during 2002 and 2003 by TrueCourse, Inc. (n = 3,651). The anti-takeover data covers only U.S. incorporated companies that are included in the major indices (e.g., *Fortune* 500, Standard & Poor's Super 1500, etc.), amended their poison pill since 2001, and/or completed a firmly underwritten IPO since 1999. The second data set consists of companies covered by Equilar, Inc. whose fiscal year-ends are between June 2002 and May 2003 with complete data on board, board committees (audit and compensation), and equity ownership by executives and board members (n = 3,000).

After merging the TrueCourse and Equilar data, we have a final sample of 2,106 individual firms with complete data. This sample spans many sectors of the economy and has a distribution of firms that is very consistent with the composition of the complete Compustat file (see Table 1, Panel A). Our sample represents approximately 70 percent of the market capitalization of the Russell 3000 as of the end of 2003.[7] Finally, our sample consists of firms that are larger, more profitable, exhibit a lower book-to-market, and have more following by analysts than all other Compustat firms (see Table 1, Panel B).[8]

Corporate Governance Indicators

We collect indicators of corporate governance in seven general categories: characteristics of the board of directors, stock ownership by executives and board members, stock ownership by institutions, stock ownership by activist holders, debt and preferred stock holdings, compensation mix variables, and anti-takeover devices. Our board of director, compensation mix, and executive and board ownership data are obtained from Equilar, stock

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[7] Our sample only covers one year and this limits our ability to generalize the results. However, the single year of data covers a very recent time period and prior work involving large samples also is restricted to a single year (e.g., Bhagat 2004; Brown and Caylor 2006; Ashbaugh-Skaife et al. 2006). We provide further discussion concerning the impact of this research design choice in Section V.

[8] Since one of our data sources (TrueCourse, Inc.) covers firms that are included in major indices, the observation that our sample consists of large firms is to be expected. To the extent that larger and more visible firms have better or more appropriate governance structures, this will tend to reduce the power of our empirical tests.

TABLE 1
Industry Composition and Comparison of Our Sample of 2,106 Firm Observations for the Fiscal Year Ending 06/30/2002 through 05/31/2003 for which Corporate Governance Information from Equilar Inc. and TrueCourse Inc. Is Available

Panel A: Industry Composition

Two-Digit SIC	Industry	Number	Percent of Sample	Compustat Composition
1	Crops	2	0.1	0.2
7	Agriculture Services	2	0.1	0.1
10	Ores	6	0.3	1.2
12	Coal	5	0.2	0.2
13	Oil & Gas	55	2.6	4.0
14	Quarry	5	0.2	0.2
15	Building—Light	9	0.4	0.6
16	Building—Heavy	4	0.2	0.2
17	Construction	3	0.1	0.3
20	Food	21	1.0	1.9
21	Tobacco	5	0.2	0.1
22	Textile Mill	6	0.3	0.7
23	Apparel	10	0.5	0.9
24	Lumber	11	0.5	0.4
25	Furniture	10	0.5	0.5
26	Paper	17	0.8	0.8
27	Printing	25	1.2	1.2
28	Chemicals	186	8.8	5.0
29	Petroleum	12	0.6	0.4
30	Rubber	15	0.7	1.1
31	Leather	6	0.3	0.2
32	Stone	9	0.4	0.6
33	Metal Work—Basic	29	1.4	1.1
34	Metal Work—Fabrication	22	1.0	1.4
35	Industrial	96	4.6	5.2
36	Electrical	127	6.0	5.5
37	Transport—Equipment	39	1.9	1.6
38	Instruments	106	5.0	4.7
39	Misc. Manufacturing	17	0.8	1.0
40	Railroad	8	0.4	0.2
42	Motor freight	12	0.6	0.6
44	Water Transport	8	0.4	0.3
45	Air Transport	15	0.7	0.6
47	Transport—Services	11	0.5	0.3
48	Communications	69	3.3	3.8
49	Utilities	75	3.6	3.0
50	Durables—Wholesale	31	1.5	2.3
51	NonDurables—Wholesale	17	0.8	1.4
52	Garden	5	0.2	0.2

(*continued on next page*)

TABLE 1 (continued)

Two-Digit SIC	Industry	Number	Percent of Sample	Compustat Composition
53	General Stores	15	0.7	0.6
54	Food Stores	9	0.4	0.6
55	Auto Dealers	13	0.6	0.3
56	Apparel—Retail	30	1.4	0.6
57	Home Equipment	15	0.7	0.5
58	Eating	20	0.9	1.4
59	Misc. Retail	45	2.1	1.7
60	Depositories	192	9.1	7.9
61	Non-depositories	14	0.7	1.5
62	Brokers	25	1.2	1.0
63	Insurance	74	3.5	2.0
64	Ins Agents	15	0.7	0.5
65	Real Estate	8	0.4	1.3
67	Trusts	107	5.1	6.9
70	Hotels	7	0.3	0.5
72	Personal Services	6	0.3	0.3
73	Business Services	284	13.5	11.0
75	Auto Repair	2	0.1	0.2
78	Movies	5	0.2	0.9
79	Amusements	16	0.8	1.1
80	Health	34	1.6	1.7
81	Legal	1	0.0	0.0
82	Educational	5	0.2	0.3
83	Social	3	0.1	0.2
87	Engineering—Retail	45	2.1	1.8
99	Nonclassifiable	5	0.2	1.0

Panel B: Comparison of Sample Firms with All Firms on Compustat

Variable	Sample Firms	All Firms	Test of Difference
Log(Market Cap.)	6.467	6.081	11.41***
ROA	0.037	0.017	4.24***
BM	0.674	0.767	5.40***
Profit Margin	0.045	0.020	2.69***
Sales Growth	0.047	0.041	0.66
# Analysts Following	4.95	3.84	8.92***

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*, **, *** Indicates significance at the 10 percent, 5 percent, and 1 percent, respectively.

For our sample of 2,106 firms with available governance data we compare difference in firm characteristics to the complete sample of 4,101 firms with available data from I/B/E/S and Compustat for the following measures:

Log(Market Cap.) = natural log of *Market Cap.*, which is the market value of equity of the firm at the end of 2002 fiscal year (Compustat data #25 * data #199);

ROA = return on average total assets for the 2002 fiscal year, using income from operations (Data #178);

(*continued on next page*)

TABLE 1 (continued)

BM = book-to-market ratio computed at the end of fiscal 2002; it is calculated as the ratio of book value of equity (Data #60) to *Market Cap;* this is computed only for firms with positive book values;
Profit Margin = ratio of operating income (Data #178) to total sales (Data #12) measured for the 2002 fiscal year;
Sales Growth = percentage change in sales (Data #12) during fiscal 2002; and
# Analysts Following = number of analysts releasing an annual earnings forecast for the 2002 fiscal year.

Financial statement variables are winsorized to be no greater than 1 in absolute value, with the exception of *BM* that is winsorized at the extreme two percentiles (i.e., values less (greater) than the 2nd (98th) percentile are set equal to the value of the 2nd (98th) percentile).

ownership by institutions and activists is collected from Spectrum data files (13F filings), debt and preferred stock data are obtained from Compustat, and anti-takeover data are collected from TrueCourse.

Drawing on prior studies (e.g., Klein 1998; Bhagat and Black 2002; Core et al. 1999; Ferris et al. 2003), our board of director variables are the number of meetings for the audit committee, compensation committee, and the total board (denoted as *# AC Meetings*, *# CC Meetings*, and *# Board Meetings*, respectively), number of directors serving on the compensation committee, audit committee, and the total board (denoted as *CC Size*, *AC Size*, and *Board Size*, respectively), fraction of board comprised of insider (executive) directors (denoted as *% Board Inside*), fraction of the compensation committee and audit committee that is comprised of affiliated directors (denoted as *% CC Affiliated* and *% AC Affiliated*, respectively),[9] indicator variables equal to 1 if the chairperson of the compensation committee and audit committee is affiliated, and 0 otherwise (denoted as *CC Chair Affiliated* and *AC Chair Affiliated*, respectively), the fraction of outside directors and affiliated directors who serve on four or more other boards, and the fraction of inside directors who serve on two or more boards (denoted as *% Busy Outsiders*, *% Busy Affiliated*, and *% Busy Insiders*, respectively), fraction of outside, affiliated, and inside directors who are older than 70 (denoted as *% Old Outsiders*, *% Old Affiliated*, and *% Old Insiders*, respectively), an indicator variable equal to 1 if there is a lead director (an outside director who can call meetings of all outside directors in executive session) on the board, and 0 otherwise (denoted as *Lead Director*), an indicator variable equal to 1 if an internal executive holds the position of chairperson of the board, and 0 otherwise (denoted as *Insider Chairman*), and the fraction of affiliated and outside directors who were appointed by existing insiders (denoted as *% Affiliated Appointed* and *% Outsiders Appointed*, respectively).[10]

Consistent with prior research (e.g., Ashbaugh-Skaife et al. 2006; Bhagat 2004; Klein 1998), the typical board meets seven times a year, has about nine members with one or two internal executives, the chairman of the board is usually an internal executive, and there is not a lead director (see Table 2). Most members of the compensation and audit committee are outsiders, but there is some evidence that the chair of these committees is an affiliated director. In contrast to inside directors, outside or affiliated directors are generally not classified as busy. Most boards are not composed of old directors, but a high percentage of the affiliated and outside directors were appointed by existing inside directors.

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[9] We use the definition of affiliated (or "grey") directors developed by Equilar (which is a combination of SEC, NYSE, and NASD guidelines). Any outside directors who were mentioned in the "certain transactions" section or a former executive were classified as affiliated.

[10] This variable was measured by comparing the term of an existing board member to the maximum term for the set of insider directors. If there were no affiliated directors, this variable was set equal to zero.

TABLE 2

Descriptive Statistics for Our Vector of Corporate Governance Variables for a Sample of 2,106 Firms for the Fiscal Year Ending 06/30/2002 through 05/31/2003

Panel A: Descriptive Statistics

Variable	Var. Type	Mean	Std. Dev.	Q1	Median	Q3
Board Variables						
# AC Meetings	CNT	6.33	2.59	4	6	8
# CC Meetings	CNT	3.92	2.17	2	4	5
# Board Meetings	CNT	7.31	2.98	5	7	9
CC Size	CNT	3.52	1.15	3	3	4
AC Size	CNT	3.69	0.99	3	3	4
Board Size	CNT	8.78	2.75	7	8	10
% Board Inside	C	20.03	10.36	12.5	16.67	25
% AC Affiliated	C	10.47	18.38	0	0	25
% CC Affiliated	C	15.62	24.03	0	0	33.33
AC Chair Affiliated	I	0.07	0.26	0	0	0
CC Chair Affiliated	I	0.12	0.33	0	0	0
% Busy Outsiders	C	8.56	14.30	0	0	16.67
% Busy Affiliated	C	5.21	18.46	0	0	0
% Busy Insiders	C	26.66	39.86	0	0	50
% Old Outsiders	C	9.88	16.75	0	0	16.67
% Old Affiliated	C	6.97	21.27	0	0	0
% Old Insiders	C	1.72	8.85	0	0	0
Lead Director	I	0.08	0.27	0	0	0
Insider Chairman	I	0.77	0.42	1	1	1
% Affiliated Appointed	C	41.19	46.37	0	0	100
% Outsiders Appointed	C	68.20	34.81	40	80	100
Stock Ownership Variables						
% Outsiders Own	C	0.05	0.08	0.01	0.02	0.06
% Executives Own (Excl. Top)	C	0.56	1.39	0.03	0.10	0.37
% Top Exec.Own	C	3.30	7.38	0.11	0.47	2.34
% Affiliated Own	C	0.96	2.12	0	0.02	0.81
Institutional Ownership Variables						
% Block Own	C	15.85	13.30	5.59	13.60	24.55
# Block	CNT	1.82	1.48	1	2	3
% Largest	C	9.14	5.05	5.53	8.32	11.67
Activist Variables						
# Activists	CNT	6.61	4.12	3	6	10
% Activists Own	C	1.94	1.41	0.73	1.84	2.89
Debt Variables						
Debt to Market	C	0.89	2.16	0.02	0.25	0.84
Preferred to Market	C	0.02	0.11	0	0	0
Compensation Mix Variables						
% Long Term Mix	C	52.91	29.34	33.14	58.59	76.93
% Accounting Mix	C	15.81	16.80	1.85	11.34	23.90
Anti-Takeover Variables						
Staggered Board	I	0.63	0.48	0	1	1
Supermajority	I	0.24	0.43	0	0	0
State Incorporated	I	0.08	0.27	0	0	0
Unequal Voting	I	0.09	0.29	0	0	0
Poison Pill	I	0.51	0.50	0	1	1

(*continued on next page*)

TABLE 2 (continued)

Variable Type refers to the nature of the variable: I (indicator variable), C (continuous variable), and CNT (count variable).

Board Variables:

# AC Meetings = number of audit committee meetings (Equilar data);
# CC Meetings = number of compensation committee meetings (Equilar data);
# Board Meetings = number of board meetings (Equilar data);
CC Size = number of directors serving on the compensation committee (Equilar data);
AC Size = number of directors serving on the audit committee (Equilar data);
Board Size = number of directors serving on the board (Equilar data);
% Board Inside = fraction of board comprised of insider (executive) directors (Equilar data);
% AC Affiliated = fraction of the audit committee that is comprised of affiliated (grey) directors; any outside director who is a former executive or who is mentioned in the "certain transactions" section of the proxy statement is classified as affiliated (Equilar data);
% CC Affiliated = fraction of the compensation committee that is comprised of affiliated (grey) directors (Equilar data);
AC Chair Affiliated = indicator variable equal to 1 if the chairperson of the audit committee is affiliated, and 0 otherwise;
CC Chair Affiliated = indicator variable equal to 1 if the chairperson of the compensation committee is affiliated, and 0 otherwise;
% Busy Outsiders = fraction of outside directors who serve on four or more other boards (Equilar data);
% Busy Affiliated = fraction of affiliated directors who serve on four or more other boards (Equilar data);
% Busy Insiders = fraction of insider directors who serve on two or more other boards (Equilar data);
% Old Outsiders = fraction of outside directors who are older than 70 (Equilar data);
% Old Affiliated = fraction of affiliated directors who are older than 70 (Equilar data);
% Old Insiders = fraction of inside directors who are older than 70 (Equilar data);
Lead Director = indicator variable equal to 1 of there is a lead director on the board, and 0 otherwise (Equilar data);
Insider Chairman = indicator variable equal to 1 if an executive holds the position of chairperson of the board, and 0 otherwise (Equilar data);
% Affiliated Appointed = fraction of affiliated directors that were appointed by existing insiders; this variable is set to 0 if there are no affiliated directors (Equilar data); and
% Outsiders Appointed = fraction of outside directors that were appointed by existing insiders; this variable is set to 0 if there are no outside directors (Equilar data).

Stock Ownership Variables:

% Outsiders Own = fraction of outstanding shares held by the average outside director (Equilar data);
% Executives Own (Excl. Top) = fraction of outstanding shares held by the average executive director but excludes the holdings of the top executive (Equilar data);
% Top Exec. Own = fraction of outstanding shares held by the top executive (Equilar data); and
% Affiliated Own = fraction of outstanding shares held by the average affiliated director (Equilar data).

All stock ownership variables include only shares of common stock held and exclude options.

Institutional Ownership Variables:

% Block Own = fraction of outstanding shares owned by blockholders (Spectrum data); a blockholder is defined as a shareholder who holds more than 5 percent of outstanding shares;
# Block = number of blockholders (Spectrum data); and
% Largest = shareholding of the largest institution (Spectrum data).

Activist Variables:

# Activists = number of activist institutions holding shares; an activist is defined as per Cremers and Nair (2005), specifically, the following public pension funds are classified as activists: institutions with the following manager numbers on Spectrum are coded as activists: California Public Employees Retirement System (12000), California State Teachers Retirement (12100 and 12120), Colorado Public Employees Retirement Association (18740), Florida State Board of Administration (38330), Illinois State Universities Retirement System (81590), Kentucky Teachers Retirement System (49050), Maryland State Retirement and Pension System (54360), Michigan State Treasury (57500), Montana Board of Investment (58650), Education Retirement Board New Mexico (63600), New York State Common Retirement Fund (63850), New York State Teachers Retirement System (63895), Ohio School Employees

(*continued on next page*)

TABLE 2 (continued)

Retirement System (66550), Ohio School Employees Retirement System (66610), Ohio State Teachers Retirement System (66635), Texas Teachers Retirement System (82895 and 83360), Virginia Retirement System (90803), State of Wisconsin Investment Board (93405); Manager numbers are in parentheses (Spectrum data); and

% Activists Own = fraction of outstanding shares held by activist institutions (Spectrum data).

Debt Variables:

Debt to Market = ratio of book value of debt (Compustat data item 9 plus data item 34) to the market value of equity (Compustat data item 199 * data item 25); and

Preferred to Market = ratio of book value of preferred equity (Compustat data item 130) to the market value of equity (Compustat data item 199 * data item 25).

Compensation Mix Variables:

% Long Term Mix = fraction of total annual CEO compensation that is comprised of performance plans, stock options and restricted stock grants; and

% Accounting Mix = fraction of total annual CEO compensation that is comprised of performance plans and annual bonus.

Anti-Takeover Variables:

Staggered Board = indicator variable equal to 1 if the firm has a staggered board, and 0 otherwise (Shark Repellant data);

Supermajority = indicator variable equal to 1 if the firm has a supermajority provision for takeovers, and 0 otherwise (Shark Repellant data);

State Incorporated = indicator variable equal to 1 if the firm is incorporated in Pennsylvania, Ohio, Wisconsin or Massachusetts, and 0 otherwise (Shark Repellant data);

Unequal Voting = indicator variable equal to 1 if there are unequal voting rights across common shareholders, and 0 otherwise (Shark Repellant data); and

Poison Pill = indicator variable equal to 1 if the firm has adopted a poison pill, and 0 otherwise (Shark Repellant data).

Our board and executive ownership variables are the fraction of outstanding shares held by the average outside director (denoted as *% Outsiders Own*),[11] fraction of outstanding shares held by the top executive (denoted as *% Top Exec Own*), fraction of outstanding shares held by the average executive director after excluding the holdings of the top executive (denoted as *% Executives Own (Excl. Top)*), and fraction of outstanding shares held by the average affiliated director (denoted as *% Affiliated Own*). Similar to prior work, the median board and executive group owns less than 1 percent of the outstanding equity (e.g., Hall and Liebman 1998). However, there is considerable skewness in these measures as evidenced by the mean being substantially larger than the median.

Institutional ownership is measured as the fraction of outstanding shares owned by blockholders (denoted as *% Block Own*), number of blockholders (denoted as *# Block*), and shareholding of the largest institutional owner (denoted as *% Largest*).[12] The average company in our sample has two blockholders that own 16 percent of the outstanding shares (with the largest blockholder owning about nine percent of the outstanding shares).

The activist variables are measured using the number of activist institutions holding shares (denoted as *# Activists*) and the fraction of outstanding shares held by activist institutions (denoted as *% Activists Own*). Activist institutions are identified using the information contained in Cremers and Nair (2005).[13] The average company in our sample has approximately seven activists holding a total of about 2 percent of the outstanding shares.

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[11] We exclude stock option holdings in our board and executive ownership computations.

[12] A blockholder is defined as a shareholder who holds more than 5 percent of outstanding shares.

The role of debt as a governance mechanism is measured using the ratio of book value of debt (Compustat data item 9 plus data item 34) to the market value of equity (Compustat data item 199 * data item 25) and ratio of book value of preferred equity (Compustat data item 130) to the market value of equity (Compustat data item 199 * data item 25). These two leverage ratios are denoted as *Debt to Market* and *Preferred to Market*, respectively. The median company has a book value of debt that is approximately 25 percent market capitalization and preferred stock that is approximately 0 percent of market capitalization.

Compensation mix is measured by two variables. First, we measure the fraction of total annual CEO compensation that is comprised of performance plans, stock options and restricted stock grants (*% Long Term Mix*).[14] Second, we measure the fraction of total annual CEO compensation that is comprised of performance plans and annual bonus (*% Accounting Mix*). Data for compensation mix are obtained from Equilar. The average firm pays slightly more than half of total CEO pay in the form of long term incentive payments, and about 16 percent in the form of accounting based incentive payments.

Our anti-takeover variables are measured using indicator variables regarding whether a firm has a staggered (or classified) board of directors (denoted as *Staggered Board*), requires a supermajority vote for a business combination (denoted as *Supermajority*), is incorporated in a state (PA, OH, MA, or WI) with relatively greater protections to incumbent management (denoted as *State Incorporated*), has unequal voting rights across shareholders or dual classes of stock (denoted as *Unequal Voting*), and has a poison pill or where stock purchases can be made at substantial discounts by existing shareholders if a hostile takeover attempt is made on the firm (denoted as *Poison Pill*).[15] Sixty-three percent of our sample has a staggered board, 24 percent requires a supermajority vote for takeovers, 8 percent are incorporated in management friendly states, 9 percent have dual classes of stock, and 51 percent have a poison pill.

III. CORPORATE GOVERNANCE INDICES

Methodology

In order to develop our corporate governance indices, we use exploratory principal component analysis (PCA) to identify the underlying dimensions or structure of corporate governance and determine which indicators are associated with each factor. We retain all factors with an eigenvalue greater than unity. This results in 14 factors that retain 61.7 percent of the total variance in the original data. This reduced solution is then rotated using an *oblique* rotation that allows the retained factors to be correlated in order to enhance interpretability of the PCA solution. These 14 factors represent the underlying dimensions of corporate governance for our selected set of indicators (see Table 3).[16]

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[13] The following public pension funds are classified as activists (Spectrum manager number): California Public Employees Retirement System (12000), California State Teachers Retirement (12100 and 12120), Colorado Public Employees Retirement Association (18740), Florida State Board of Administration (38330), Illinois State Universities Retirement System (81590), Kentucky Teachers Retirement System (49050), Maryland State Retirement and Pension System (54360), Michigan State Treasury (57500), Montana Board of Investment (58650), Education Retirement Board New Mexico (63600), New York State Common Retirement Fund (63850), New York State Teachers Retirement System (63895), Ohio School Employees Retirement System (66550), Ohio School Employees Retirement System (66610), Ohio State Teachers Retirement System (66635), Texas Teachers Retirement System (82895 and 83360), Virginia Retirement System (90803), State of Wisconsin Investment Board (93405).

[14] Salary and annual bonus are valued based on payments, performance plans are valued using the target payout, stock options are valued using the Black-Scholes model, and restricted stock is valued using the stock price at the date of grant.

[15] The TrueCourse data consists of 15 individual anti-takeover provisions. Rather than attempting to analyze this extensive set of variables, we restrict our attention to a smaller subset of key anti-takeover variables (similar to Gompers et al. [2004] who focus on dual class companies and Bebchuk and Cohen [2005] who focus on the presence of a staggered board). One provision that is commonly used in prior work is blank check preferred (e.g., Daines and Klausner 2001). We drop this provision because 92 percent of the sample has blank check preferred, thus there is little variance in this variable.

To interpret the factors, it is necessary to determine which indicators have a statistical and substantive association with each factor. We associate each factor with those variables that have a loading (or the correlation between the factor and an indicator) that exceeds 0.40 in absolute value and are statistically different from zero at conventional levels. Statistical significance is determined using traditional bootstrapping methods (1,000 samples with replacement) for the rotated 14 factor solution. The resulting variables that are associated with each factor are summarized in Table 3.

Each factor (or index) is assigned a name based on the characteristics of the indicators that are related to the factor. Several of the factors are associated with indicators that one might expect *ex ante* to be highly correlated (e.g., *Meetings* and *Board Size*), and thus it is simple to name these factors. However, the naming of other factors can be more difficult. For example, the first factor has three relevant indicators that are measures of stock ownership with two of the indicators related to activist institutions and a third indicator with a negative loading related to ownership by outside directors. Thus, this governance factor is named "Active" and high scores on this factor are associated with activist interest but low outside director interest. The third factor has four indicators that are all related to affiliated directors holding important positions on the audit and compensation committees. Thus, this governance factor is named "Affiliated." We use this general approach to name the other factors described in Table 3.[17]

The PCA results in Table 3 produce an interpretable solution (e.g., there are no significant cross-loadings or situations where the same indicator is associated with more than one factor). However, since corporate governance is a complex general construct, it should not be surprising to find some unexpected results in the PCA solution. For example, *% Affiliated Own* loads (negatively) on the factor that we name "Anti-Takeover I." The primary indicators of this factor measure the extent of anti-takeover provisions adopted by the firm via poison pills and the presence of a staggered (or classified) board and we use these associations to name this factor. Although somewhat speculative, *% Affiliated Own* may load on this factor because there is no need in these organizations for affiliated directors to take an equity position to protect against takeover threats.

With the exception of Active, Anti-Takeover I, Compensation Mix, and Lead Director, the governance index scores are computed using the average equal-weighted sum of the

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[16] We use an *exploratory* approach to gain some initial insight into the structure of corporate governance because there is little prior theory or empirical analysis regarding the dimensions of corporate governance. However, once a consistent result emerges about these dimensions and appropriate indicators, it would be natural for researchers to adopt a *confirmatory* latent variable methodological approach.

[17] The PCA results also highlight another problematic aspect of prior research using and interpreting a single indicator. For example, assume that a researcher considers the structure of *committees* more important than the structure of the overall board for understanding earning manipulation. As a result, committee size and number of committee meetings are used in the regression analysis. Assume that the results are statistically significant in the expected direction for these variables (e.g., larger committees and fewer committee meetings are associated with higher abnormal accruals). However, it is not appropriate to conclude that *committee* structure has a more important association with earnings management than overall board structure because the PCA shows that these two indicators load on the same factor. Thus, it is problematic to distinguish between the two variables.

TABLE 3
Exploratory Principal Component Analysis (PCA)

Factor	Component Loading	Standard Error	Factor	Component Loading	Standard Error
Active			Anti-Takeover I		
# Activists	0.654	0.066	*Poison Pill*	0.665	0.139
% Activists Own	0.625	0.070	*% Affiliated Own*	−0.517	0.173
% Outsiders Own	−0.665	0.072	*Staggered Board*	0.476	0.225
Block			Old Directors		
% Block Own	0.985	0.003	*% Old Outsiders*	0.688	0.334
# Block	0.877	0.008	*% Old Affiliated*	0.563	0.312
% Largest	0.848	0.008	*% Old Insiders*	0.605	0.332
Affiliated			Debt		
% AC Affiliated	0.822	0.183	*Debt to Market*	0.778	0.296
% CC Affiliated	0.627	0.072	*Preferred to Market*	0.804	0.306
AC Chair Affiliated	0.824	0.242			
CC Chair Affiliated	0.536	0.089			
Insider Appointed			Insider Power		
% Affiliated Appointed	0.752	0.089	*% Executives Own (Excl. Top)*	0.737	0.193
% Outsiders Appointed	0.768	0.095	*% Top Exec. Own*	0.720	0.181
			% Board Inside	0.467	0.105
			Unequal Voting	0.396	0.200

(continued on next page)

TABLE 3 (continued)

Factor	**Component Loading**	**Standard Error**	**Factor**	**Component Loading**	**Standard Error**
Compensation Mix			Board Size		
% Long Term Mix	−0.824	0.386	*CC Size*	0.884	0.017
% Accounting Mix	0.896	0.465	*AC Size*	0.872	0.019
			Board Size	0.693	0.032
Meetings			Anti-Takeover II		
# AC Meetings	0.762	0.111	*Supermajority*	0.625	0.294
# CC Meetings	0.678	0.108	*State Incorporated*	0.792	0.388
# Board Meetings	0.695	0.115			
Lead Director			Busy Directors		
Lead Director	0.842	0.412	*% Busy Outsiders*	0.424	0.208
Insider Chairman	0.441	0.177	*% Busy Affiliated*	0.698	0.321
			% Busy Insiders	0.452	0.202

Factors are computed using PCA where we retain all factors with an eigenvalue greater than 1. This table reports the loadings on individual governance variables for each of the 14 factors (reported in order of total variance explained). We retain variables where the absolute value of the loading exceeds 0.4 and the loading is significant at conventional levels (using boot-strapped standard errors).

All variables are as defined in Table 2.

standardized indicators associated with each factor (Grice and Harris 1998). The four factors mentioned above (the exceptions) either contain substitute mechanisms or exhibit a combination of positive and negative loadings. To compute factor scores for these four factors, we explicitly incorporate this substitutability across components. For example, the factor Active exhibits a negative association between stockholdings of outside directors and equity ownership by activist funds. We compute the Active factor as the sum of the standardized *# Activists* and *% Activists Own* less standardized *% Outsiders Own*, divided by 3. The remaining three factor scores are calculated using the respective standardized components as follows to reflect the substitutability: Anti-Takeover I is the sum of *Staggered Board* and *Poison Pill* minus *% Affiliated Own*, divided by 3. Compensation Mix is *% Accounting Mix* minus *% Long Term Mix*, divided by 2. Lead Director is *Lead Director* minus *Insider Chairman*, divided by 2 (i.e., this factor is increasing in external monitoring). The descriptive statistics for the computed factors scores are presented in Table 4 (Panel A). Since these scores are weighted combinations of standardized variables, the mean governance score for each index is equal to zero.

The reliability (or the inverse of estimated measurement error) of the indices is computed using Cronbach's alpha for indicators associated with each governance construct. The mean (median) coefficient alpha is 0.532 (0.568). Although the levels of reliability are somewhat lower than the benchmarks suggested by Nunnally (1967), low levels of reliability are common in the early stages of measurement development. Moreover, our governance indices will almost certainly have higher reliability than the single indicators that are commonly used in empirical research. In addition, none of the confidence intervals for correlations among the governance indices include unity at conventional levels of statistical significance (Table 4, Panel B). This suggests that our governance indices are statistically distinct and exhibit construct validity.[18] The reliability and construct validity analyses suggest that psychometric properties of the indices are reasonable given the exploratory nature of this study. We certainly acknowledge that our indices are not perfect and it is important to refine corporate governance indices in future research.

Expected Associations

We classify Board Size, Affiliated, Insider Appointed, Insider Power, Anti-Takeover I, Anti-Takeover II, Old Directors, and Busy Directors as *increasing* in "bad" governance. Prior research suggests that firms with bigger boards perform worse than firms with smaller boards (Yermack 1996). The presence of affiliated directors on the board and various committees is often argued as compromising the independence of the board/committee (Klein 1998). The presence of a dual CEO-Chairperson (Yermack 1996) and outsiders and/or affiliates who have been appointed by incumbent management also is assumed to erode the independence of the board. Both anti-takeover factors capture measures that are designed to reduce the power of the market for corporate control in disciplining the firm. Finally, old and busy directors are likely to be less active monitors relative to younger and less busy directors (e.g., Core et al. 1999).

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[18] While many of these correlations between factors are statistically significant at conventional levels, the absolute value for most of these correlations is small in magnitude. With regard to some of the larger correlations (Spearman denoted as r_s, Pearson as r_p), we observe that companies with activist shareholders tend to be associated with companies with larger boards ($r_s = 0.356$, $r_p = 0.301$) and busy directors ($r_s = 0.372$, $r_p = 0.325$). Firms with insider appointed boards tend to have considerable power concentrated within the firm ($r_s = 0.346$, $r_s = 0.270$). Finally, firms with affiliated directors serving on key board committees tend not to adopt anti-takeover provisions ($r_s = -.317$, $r_p = -0.245$).

TABLE 4
Descriptive Statistics and Correlations for the Factor Scores

Panel A: Descriptive Statistics[a]

Factor	Percent Explained	Mean	Std. Dev.	Q1	Median	Q3
Active	10.72	0	0.788	−0.559	0.002	0.729
Block	7.41	0	0.908	−0.677	−0.079	0.639
Affiliated	5.86	0	0.735	−0.467	−0.467	0.247
Insider Appointed	5.43	0	0.836	−0.706	0.013	0.856
Comp. Mix	4.85	0	0.872	−0.696	−0.162	0.481
Meetings	3.87	0	0.739	−0.547	−0.093	0.445
Lead Director	3.53	0	0.654	−0.419	−0.419	0.765
Anti-Takeover I	3.28	0	0.650	−0.625	0.041	0.714
Old Directors	3.03	0	0.814	−0.371	−0.371	0.127
Debt	2.94	0	0.658	−0.292	−0.235	−0.066
Insider Power	2.84	0	0.835	−0.425	−0.226	0.168
Board Size	2.73	0	0.667	−0.600	−0.216	0.391
Anti-Takeover II	2.61	0	0.767	−0.425	−0.425	0.749
Busy Directors	2.61	0	0.651	−0.516	−0.183	0.320

(*continued on next page*)

TABLE 4 (continued)

Panel B: Correlations: Pearson (Spearman) Correlations are Presented in the Upper (Lower) Diagonal[b]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Active (1)	—	.088 (.000)	−.197 (.000)	−.067 (.002)	−.159 (.000)	.209 (.000)	.213 (.000)	−.036 (.099)	−.082 (.000)	−.183 (.000)	.301 (.000)	−.075 (.001)	.063 (.004)	.325 (.000)
Block (2)	.097 (.000)	—	−.059 (.007)	−.041 (.060)	−.037 (.088)	−.050 (.022)	.029 (.187)	−.027 (.215)	−.021 (.328)	.024 (.269)	−.155 (.000)	.047 (.030)	−.049 (.023)	.003 (.906)
Affiliated (3)	−.217 (.000)	−.076 (.000)	—	.167 (.000)	.043 (.051)	−.056 (.010)	−.245 (.000)	.093 (.000)	.141 (.000)	.088 (.000)	−.069 (.002)	.008 (.730)	−.050 (.021)	−.017 (.427)
Insider Appointed (4)	−.093 (.000)	−.039 (.074)	.248 (.000)	—	.022 (.322)	−.124 (.000)	−.086 (.000)	.119 (.000)	−.013 (.548)	.270 (.000)	−.082 (.000)	−.214 (.000)	−.033 (.129)	−.044 (.042)
Compensation Mix (5)	−.150 (.000)	−.058 (.008)	.037 (.088)	.005 (.812)	—	−.147 (.000)	−.039 (.074)	.096 (.000)	.056 (.010)	.131 (.000)	.087 (.000)	−.042 (.057)	.110 (.000)	−.098 (.000)
Meetings (6)	.241 (.000)	−.041 (.057)	−.066 (.002)	−.141 (.000)	−.138 (.000)	—	.117 (.000)	−.068 (.002)	.092 (.000)	−.198 (.000)	.222 (.000)	.086 (.000)	.027 (.222)	.071 (.001)
Anti-Takeover I (7)	.236 (.000)	.036 (.099)	−.317 (.000)	−.139 (.000)	−.016 (.453)	.126 (.000)	—	−.042 (.052)	−.097 (.000)	−.170 (.000)	.169 (.000)	−.027 (.207)	.139 (.000)	.036 (.097)
Old Directors (8)	−.016 (.457)	−.042 (.053)	.061 (.005)	.077 (.000)	.104 (.000)	−.048 (.026)	−.081 (.000)	—	.012 (.568)	.127 (.000)	.027 (.208)	−.026 (.233)	.036 (.097)	−.024 (.280)
Debt (9)	.070 (.001)	−.052 (.017)	.008 (.699)	−.022 (.309)	.219 (.000)	.165 (.000)	.047 (.030)	.077 (.000)	—	.035 (.112)	.028 (.198)	−.009 (.673)	.003 (.904)	−.007 (.761)
Insider Power (10)	−.251 (.000)	.031 (.154)	.079 (.000)	.346 (.000)	.029 (.183)	−.224 (.000)	−.158 (.000)	.094 (.000)	−.112 (.000)	—	−.256 (.000)	−.197 (.000)	−.033 (.128)	−.169 (.000)
Board Size (11)	.356 (.000)	−.129 (.000)	−.059 (.007)	−.104 (.000)	.143 (.000)	.247 (.000)	.181 (.000)	.091 (.000)	.319 (.000)	−.361 (.000)	—	.024 (.262)	.190 (.000)	.198 (.000)
Lead Director (12)	−.096 (.000)	.037 (.092)	.019 (.384)	−.223 (.000)	−.028 (.206)	.063 (.004)	−.043 (.047)	−.001 (.977)	−.023 (.293)	−.210 (.000)	.018 (.414)	—	.002 (.933)	−.012 (.580)
Anti-Takeover II (13)	.071 (.001)	−.060 (.006)	−.061 (.005)	−.030 (.174)	.156 (.000)	.024 (.277)	.132 (.000)	.036 (.094)	.138 (.000)	−.054 (.014)	.215 (.000)	−.006 (.800)	—	−.009 (.678)
Busy (14)	.372 (.000)	.039 (.076)	−.036 (.095)	−.075 (.001)	−.114 (.000)	.077 (.000)	.059 (.006)	−.021 (.339)	.081 (.000)	−.236 (.000)	.214 (.000)	−.022 (.305)	−.005 (.820)	—

(*continued on next page*)

TABLE 4 (continued)

Panel C: Pearson Correlations: Governance Factors with Accounting Outcomes and Organizational Performance

	Abnormal Accruals	*|Abnormal Accruals|*	*Restatement*	*ROA*	*Alpha*
Active	.070 (.007)	−.155 (.000)	−.018 (.411)	.217 (.000)	.024 (.269)
Block	.076 (.003)	−.024 (.349)	.009 (.689)	.008 (.701)	.013 (.547)
Affiliated	−.051 (.047)	.070 (.007)	−.015 (.488)	−.059 (.007)	−.057 (.009)
Insider Appointed	.025 (.329)	.014 (.589)	−.024 (.263)	−.017 (.453)	−.019 (.377)
Compensation Mix	.069 (.007)	−.075 (.004)	.000 (.986)	.115 (.000)	.062 (.005)
Meetings	−.003 (.913)	−.027 (.305)	.105 (.000)	.018 (.417)	.007 (.745)
Anti-Takeover I	.028 (.287)	−.073 (.005)	.009 (.675)	.015 (.506)	.011 (.614)
Old Directors	.027 (.299)	−.046 (.074)	−.025 (.256)	.042 (.057)	−.012 (.581)
Debt	−.009 (.729)	−.049 (.060)	.052 (.018)	−.057 (.010)	−.101 (.000)
Insider Power	.049 (.057)	.020 (.448)	.031 (.150)	.005 (.829)	−.049 (.025)
Board Size	.027 (.290)	−.190 (.000)	.003 (.906)	.154 (.000)	.029 (.186)
Lead Director	−.041 (.112)	.001 (.981)	.011 (.620)	−.032 (.151)	.045 (.040)
Anti-Takeover II	.068 (.008)	−.098 (.000)	−.010 (.634)	.093 (.000)	−.009 (.674)
Busy	.014 (.594)	−.071 (.006)	.011 (.619)	.042 (.056)	.003 (.886)

(continued on next page)

TABLE 4 (continued)

Panel D: Spearman Correlations: Governance Factors with Accounting Outcomes and Organizational Performance[b]

	Abnormal Accruals	*|Abnormal Accruals|*	*Restatement*	*ROA*	*Alpha*
Active	.038 (.146)	−.159 (.000)	−.013 (.540)	.239 (.000)	−.011 (.627)
Block	.072 (.005)	−.004 (.883)	.008 (.724)	.001 (.973)	−.021 (.345)
Affiliated	−.004 (.884)	.075 (.004)	−.008 (.709)	−.065 (.003)	.036 (.102)
Insider Appointed	.039 (.132)	.030 (.248)	−.023 (.288)	−.013 (.564)	.018 (.426)
Compensation Mix	.026 (.323)	−.090 (.000)	−.010 (.631)	.117 (.000)	.133 (.000)
Meetings	−.020 (.446)	−.032 (.213)	.088 (.000)	−.061 (.006)	.003 (.902)
Anti-Takeover I	.005 (.847)	−.083 (.001)	.013 (.561)	−.005 (.803)	−.028 (.203)
Old Directors	−.011 (.683)	−.033 (.204)	.002 (.917)	.031 (.158)	.021 (.348)
Debt	−.046 (.074)	−.190 (.000)	.075 (.001)	−.186 (.000)	.104 (.000)
Insider Power	.031 (.228)	.098 (.000)	.018 (.409)	−.011 (.613)	−.050 (.024)
Board Size	−.039 (.129)	−.211 (.000)	−.010 (.654)	.099 (.000)	.064 (.004)
Lead Director	−.058 (.025)	−.023 (.365)	.014 (.528)	−.042 (.055)	.058 (.008)
Anti-Takeover II	.050 (.051)	−.093 (.000)	−.003 (.888)	.064 (.004)	.034 (.127)
Busy	−.001 (.963)	−.102 (.000)	.013 (.551)	.049 (.026)	.005 (.811)

(*continued on next page*)

TABLE 4 (continued)

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[a] Factor scores are calculated as the average of the standardized components with the exception of Active, Anti-Takeover I, Compensation Mix, and Lead Director. These factors have substitute components. These factor scores are calculated using the respective standardized components as follows to reflect the substitutability: Active is the sum of *# Activists* and *% Activist Own* minus *% Outsider Own*, divided by 3. Anti-Takeover I is the sum of *Staggered Board* and *Poison Pill* minus *% Affiliated Own*, divided by 3. Compensation Mix is *% Accounting Mix* minus *% Long Term Mix*, divided by 2. Lead Director is *Lead Director* minus *Insider Chairman*, divided by 2.

[b] The numbers in parentheses are the two-tailed significance levels.

The accrual model is estimated using the Jones (1991) technique of decomposing total accruals into a normal (expected) and abnormal (unexpected) component. The method of decomposition is as follows:

$$TA = \alpha + \beta_1(\Delta Sales - \Delta REC) + \beta_2 PPE + \beta_3 BM + \beta_4 CFO + \varepsilon$$

where:

TA = difference between Compustat reported operating cash flows (with extraordinary items and discontinued operations reclassified as part of operating cash flows, i.e., item 308 minus item 124) and income before extraordinary items (item 123);
$\Delta Sales$ = change in sales (item 12) for the year;
ΔREC = change in receivables reported on the statement of cash flows (item 302) for the year;
PPE = gross amount of property, plant, and equipment (item 7); and
CFO = operating cash flows (item 308).

All variables used in the abnormal accrual model (except BM) are scaled by average total assets using assets from the start and end of the fiscal year. The regression is run for every two-digit SIC group in the sample with a requirement of at least ten observations in each group. Independent variables in the accrual model are all winsorized to be no greater than 1 in absolute value, with the exception of BM that is winsorized at the extreme two percentiles (i.e., values less (greater) than the 2nd (98th) percentile are set equal to the value of the 2nd (98th) percentile).

Abnormal Accruals = residual from the above equation;
|Abnormal Accruals| = absolute value of the residual;
Restatement = indicator variable equal to 1 if the firm reports an earnings restatement related to the fiscal year (or a subsequent fiscal period) for which we have governance data, and 0 otherwise:
For example, firm XYZ has a December 31, 2002 fiscal year end. If XYZ restates its earnings for any of the fiscal periods from January 1, 2002 onward Earnings Restatement = 1. Firms that restate earnings in an earlier fiscal period are dropped from the analysis. For example, if firm XYZ had a restatement prior to January 1, 2002 we exclude that observation from our analysis. This leaves us with a sample of 2,095 firms of which 118 restate earnings. We exclude earlier restatements because we cannot be sure that the governance structures we measure have changed in response to the restatement;
ROA (return on assets) = calculated as income before extraordinary items (Compustat data item 178) scaled by average total assets; and
Alpha = intercept from a regression of monthly firm excess returns (excess over the risk free rate) on the monthly factor returns (MKT, SMB, HML, and UMD). The factor returns are obtained from Ken French's website. For each firm we use up to 30 months of return data to generate alpha.

Compensation mix is increasing in remuneration paid on the basis of accounting numbers and decreasing in remuneration paid in stock options and restricted stock. Accounting-based compensation plans may create perverse incentives for management to be myopic in their decision making with subsequent adverse consequences for firm value. Conversely, others have argued that the option intensity of executive compensation packages has created perverse incentives for managerial decision making (e.g., Erickson et al. 2006; Peng and Roell 2006). Therefore, we classify Compensation Mix as weakly increasing in "bad" governance.

Active, Block, Meetings, Debt, and Lead Director are classified as *increasing* in "good" governance. The presence of a large, and/or active blockholder is typically argued to be beneficial through the monitoring benefit of a financially sensitive shareholder (Shleifer and Vishny 1997). The number of meetings held by the board and committees should be evidence of monitoring activity. The presence of debtholders also offers additional monitoring benefit via external capital providers that have the incentive and ability to monitor firm activity to protect invested principle. The appointment of a non-executive director as a lead director is expected to create additional monitoring benefit on incumbent management.

The Pearson (r_p) and Spearman (r_s) bivariate correlations between the 14 governance factors and our set of outcome variables are reported in Table 4 (Panels C and D, respectively). Most of these correlations are small in absolute value and the Pearson and Spearman correlations are very similar. The most pronounced correlations involve ROA and Active ($r_p = 0.217$, $r_s = 0.239$) and the absolute value of abnormal accruals and Board Size ($r_p = -0.190$, $r_s = -0.211$). However, even these correlations are quite low and sign of the correlation between the absolute value of abnormal accruals and Board Size is opposite to our expectations.

IV. RESULTS

Our methodological approach is similar to the techniques used in most prior work examining the impact of corporate governance on various dependent variables. In particular, we use a multiple regression (or logistic) model of the following form:

$$Dependent\ Variable_{i,t} = \alpha + \Sigma\gamma Controls_{i,t} + \Sigma\beta Governance\ Factors_{i,t} + \varepsilon_{i,t}. \quad (1)$$

One important feature in the structure of Equation (1) is that the governance factors are assumed to have no impact on the controls (and thus no *indirect* impact on the dependent variable). As a result, this structure may result in conservative estimates for the impact of governance on the dependent variable. Another approach is to only include governance factors as independent variables, or:

$$Dependent\ Variable_{i,t} = \alpha + \Sigma\beta Governance\ Factors_{i,t} + \varepsilon_{i,t}. \quad (2)$$

The structure in Equation (2) would be appropriate if governance impacts the control variables and both the governance and control variables impact the dependent variable (i.e., the estimated regression coefficients for the governance variables will capture the *total* effect or the sum of the direct effect and the indirect effect through the controls). Both sets of regression estimations are included in our analyses. We also compute the total R^2 for the governance indices and separate incremental R^2s for governance and the controls.[19] We report the statistical significance and explanatory power for the governance factors both before and after including various control variables, thereby allowing us to assess a lower and upper bound for the explanatory power of the governance factors.

In the absence of a sophisticated theoretical model, we make the traditional assumption that higher levels of governance are associated with better accounting and economic outcomes for the firm. We expect a negative (positive) relation between governance indices that are hypothesized as "good" ("bad") and abnormal accruals and restatements and a positive (negative) relation between governance indices that are hypothesized as "good" ("bad") and future operating and stock price performance.

Abnormal Accruals

Accruals, Control Variables, and Prior Literature

Measures of abnormal accruals are typically used as surrogates for earnings quality (e.g., Klein 2002; Frankel et al. 2002). The flexibility afforded through accrual accounting makes the accrual component of earnings less reliable than the cash flow component and therefore a potentially useful measure for examining the quality of financial reports. As is standard in the literature, we are interested in identifying the "unexpected" (also called discretionary or abnormal) component of total accruals. Jones (1991) is the standard technique used for this decomposition. Total accruals are regressed on variables that are expected to vary with "normal" accruals. We use a cross-sectional (as opposed to time-series) version of the Jones model due to its superior specification and less restrictive data requirements (DeFond and Subramanyam 1998; Bartov et al. 2001). Limitations of this measure are the standard criticisms associated with any expectation model. Deficiencies in the set of independent variables (such as alternative measures of contracting or capital market pressures) and the functional form can lead to misclassification of normal accruals as abnormal and vice versa (e.g., Bernard and Skinner 1996).

We use an accrual model that builds on the modified Jones model of Dechow et al. (1995). The modified Jones model assumes that the change in revenues less the change in accounts receivable is free from managerial discretion (i.e., credit sales are assumed to be abnormal) and that capital intensity drive normal accruals. We include two additional independent variables that have been shown to be correlated with measures of unexpected accruals. First, we include the book-to-market ratio (*BM*). *BM* is measured as the ratio of the book value of common equity (Compustat item 60) to the market value of common equity (Compustat item 25 × item 199). *BM* is included as a proxy for expected growth in the firm's operations. We expect to see large accruals for growing firms (see also McNichols 2000, 2002). Second, we include a measure of current operating performance. Previous research has shown that measures of unexpected accruals are more likely to be misspecified for firms with extreme levels of performance (Dechow et al. 1995). We therefore include current operating cash flows, *CFO* (Compustat item 308), as an additional independent variable. Our extended model is estimated as follows:

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[19] As with all studies of this type, endogeneity is a potential problem because most (perhaps all) of the governance constructs are choice variables. This econometric problem will produce inconsistent estimates for both the coefficients and standard errors. As discussed in Larcker (2003) and Larcker and Rusticus (2006), it is not clear how to resolve this problem unless exogenous instruments can be identified and n-stage least squares methods are used in the estimation. We acknowledge that our results are limited by the endogeneity of our independent variables. We provide one attempt at addressing endogeneity in Section V.

$$TA_{i,t} = \alpha + \beta_1(\Delta Sales - \Delta REC)_{i,t} + \beta_2 PPE_{i,t} + \beta_3 BM_{i,t} + \beta_4 CFO_{i,t} + \varepsilon_{i,t}. \quad (3)$$

Total Accruals (*TA*) is the difference between operating cash flows (Compustat item 308 less item 124) and income before extraordinary items (item 123) as reported on the statement of cash flows. We make an adjustment for extraordinary items and discontinued operations consistent with Hribar and Collins (2002). *ΔSales* is the change in sales (item 12) from the previous year to the current year, *ΔREC* is the difference in accounts receivable (item 302) from the start to the end of the year, and *PPE* is the end of year property, plant, and equipment (item 7). All variables are scaled by the average of total assets using assets from the start and end of the fiscal year (item 6). The residual value from this model is labeled *Abnormal Accruals*, the estimate of unexpected or abnormal accruals from our extended Jones model. Independent variables in the accrual model are all winsorized to be no greater than 1 in absolute value, with the exception of *BM* that is winsorized at the 2nd and 98th percentiles. We estimate the model for each two-digit SIC group separately with the requirement that there be at least ten firms in each group. This leaves a sample size of 1,484 firms for the abnormal accrual analysis.

Consistent with prior research, we find a positive coefficient on (*ΔSales* − *ΔREC*) and a negative coefficient on *PPE* (the traditional parameters in the modified Jones model). We also find that *BM* and *CFO* are both negatively associated with total accruals. The explanatory power of the abnormal accrual model (adjusted R^2) is, on average, 27 percent across industry groups.

Previous research has found only weak associations between measures of corporate governance (such as the composition of the board and audit committees, financial expertise of board and committee members, and stock ownership of board members) and measures of the *absolute* value of abnormal accruals (e.g., Klein 2002). It is, however, not clear how robust these patterns are to more recent and larger samples, inclusion of a more complete set of governance factors and whether the results are driven by directional or nondirectional accrual measures.

Abnormal Accruals and Governance Factors

The results on the association between measures of abnormal accruals and our 14 governance factors are reported in Table 5. For our sample of 1,487 firms the mean abnormal accrual is close to zero and the mean absolute value of abnormal accruals is about 6 percent of average assets.[20] These descriptive statistics are similar to prior research (e.g., Larcker and Richardson 2004).

The results for the directional or signed abnormal accrual measure are reported in Table 5 (Panel A). For this outcome measure, we find that only Active, Block, Compensation Mix, Insider Power, and Anti-Takeover II are statistically significant at conventional levels. However, the signs for Active, and Block are opposite to our expectations. The regression model has an adjusted R^2 of 1.60 percent. When we examine the absolute value of abnormal accruals (Panel B), we find the expected result that firms with activist shareholders report lower absolute abnormal accruals. However, we continue to observe unexpected associations (Old Directors, Board Size, and Anti-Takeover II have opposite signs to our predictions). The adjusted R^2 for nondirectional accruals is 5.34 percent.

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[20] The sample size used to estimate the regression is based on the total sample of observations with complete data after deleting observations where the absolute value of the studentized residual is greater than 4. This approach is used in all of our analyses to mitigate the influence of "outliers." Less than 1 percent of the observations are affected by this methodological choice.

TABLE 5
Relation between Abnormal Accruals and Governance Factors

$$Abnormal\ Accruals_t = \alpha + \Sigma\beta Governance\ Factors_t + \varepsilon_t$$

		Ordinary Least Squares		**Recursive Partitioning**
Variable	**Pred. Sign**	**Governance Only Specification**		**Governance Only Specification**
Panel A: Signed Abnormal Accruals				
Governance		Coef. Est.	t-statistic	
Intercept		0.009	4.57	
Active	−	0.008	2.52**	Nonlinear
Block	−	0.006	2.69***	
Affiliated	+	−0.004	1.41	
Insider Appointed	+	0.003	1.15	
Compensation Mix	+/?	0.004	1.78*	
Meetings	−	−0.001	−0.16	
Lead Director	−	−0.003	−0.90	
Anti-Takeover I	+	−0.001	−0.15	
Old Directors	+	0.003	1.04	
Debt	−	−0.002	−0.68	
Insider Power	+	0.006	1.82*	
Board Size	+	−0.001	−0.41	
Anti-Takeover II	+	0.005	1.94*	
Busy Directors	+	0.000	0.10	
Controls				
NA				
Sample Size		1,487		1,487
R^2 (Adj. R^2) Governance Factors Only		2.50% (1.60%)		1.43%
Panel B: Absolute Value Abnormal Accruals				
Governance		Coef. Est.	t-statistic	
Intercept		0.052	37.03	
Active	−	−0.008	−4.03***	
Block	−	0.000	0.10	Nonlinear
Affiliated	+	0.003	1.60	
Insider Appointed	+	0.000	−0.14	
Compensation Mix	+/?	−0.002	−1.08	
Meetings	−	0.003	1.37	
Lead Director	−	−0.003	−1.28	
Anti-Takeover I	+	0.000	0.04	
Old Directors	+	−0.005	−2.21**	
Debt	−	−0.004	−1.47	Linear (−)
Insider Power	+	−0.001	−0.61	
Board Size	+	−0.010	−4.79***	Linear (−)
Anti-Takeover II	+	−0.003	−1.64*	
Busy Directors	+	0.000	0.22	
Controls				
NA				
Sample Size		1484		1,484
R^2 (Adj. R^2) Governance Factors Only		6.24% (5.34%)		7.17%

(continued on next page)

TABLE 5 (continued)

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*,**,*** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed tests) for the regression specification.

For the recursive partitioning analysis we report only those governance factors that were significant ($p < 0.05$, two-tailed) and note whether the relation was linear or nonlinear. If linear, we also note the sign of the relation.

The accrual model is estimated using the Jones (1991) technique of decomposing total accruals into a normal (expected) and abnormal (unexpected) component. The method of decomposition is as follows:

$$TA = \alpha + \beta_1(\Delta Sales - \Delta REC) + \beta_2 PPE + \beta_3 BM + \beta_4 CFO + \varepsilon$$

where:

TA = difference between Compustat reported operating cash flows (with extraordinary items and discontinued operations reclassified as part of operating cash flows, i.e., item 308 minus item 124) and income before extraordinary items (item 123);
$\Delta Sales$ = change in sales (item 12) for the year;
ΔREC = change in receivables reported on the statement of cash flows (item 302) for the year;
PPE = gross amount of property, plant, and equipment (item 7); and
CFO = operating cash flows (item 308).

All variables used in the abnormal accrual model (except *BM*) are scaled by average total assets using assets from the start and end of the fiscal year. The regression is run for every two-digit SIC group in the sample with a requirement of at least 10 observations in each group. Independent variables in the accrual model are all winsorized to be no greater than one in absolute value, with the exception of *BM* that is winsorized at the extreme two percentiles (i.e., values less (greater) than the 2nd (98th) percentile are set equal to the value of the 2nd (98th) percentile).

Abnormal Accruals = residual from the above equation; and
|*Abnormal Accruals*| = absolute value of the residual.

There are a variety of reasons (e.g. contractual, tax, capital market pressures) that create incentives for firms to manage earnings. It is important to note that our abnormal accrual measure is orthogonal to growth and performance. To the extent that these firm characteristics are associated with the incentives to manage earnings (e.g., need to raise external capital, desire to avoid disappointing expectations so as not to suffer from a "torpedo" effect [Sloan and Skinner 2002]), our abnormal accruals measure controls for these incentives. Therefore, we do not include additional controls in the models presented in Panels A and B of Table 5.

Similar to Klein (2002), Jenkins (2002), and Xie et al. (2003), the analyses in Table 5 reveal a modest association between our governance indices and abnormal accruals. The most pronounced association is for the absolute value of abnormal accruals (where 5.34 percent of the variation is explained with our governance factors). However, the majority of the governance factors that were significant (three out of four) exhibit unexpected associations.

It is conceivable that the somewhat weak and unexpected outcomes in Table 5 are the result of using an unreliable accrual measure. In order to assess this possibility, we examine seven alterative measures of the quality of the financial reporting system. The first measure is the accrual estimate produced by the performance-matched technique described in Kothari et al. (2005). The inferences from this accrual analysis are similar to those in Table 5. In particular, Active continues to be negatively associated with directional performance matched abnormal accruals, but the adjusted R^2 from this specification is only 0.2 percent.

The remaining alternative measures are conservatism, timeliness, smoothness, persistence, value relevance, and accrual quality (Verdi 2006). Each of these alternative measures are estimated at the firm level using ten years of data leading up to and including the fiscal year for which we have our governance data. Due to the various data requirements for these measures (outlined below) we are left with 638 firms for these additional analyses.

Our measures of timeliness and conservatism follow the reverse regression methodology from Francis et al. (2004). Specifically, we run the following regression:

$$EARN_{j,t} = \alpha_{0,j} + \alpha_{1,j}NEG_{j,t} + \beta_{1,j}RET_{j,t} + \beta_{2,j}NEG_{j,t} \cdot RET_{j,t} + \eta_{j,t} \tag{4}$$

where $NEG_{j,t} = 1$ if $RET_{j,t} < 0$, and 0 otherwise. $EARN_{j,t}$ is firm *j*'s income before extraordinary items, *NIBE* (Compustat item 18) in year *t*, scaled by market value of equity at the end of year $t-1$. $RET_{j,t}$ is firm *j*'s 15-month return ending three months after the end of the fiscal year *t*. *Timeliness* is based on the negative of the explanatory power for Equation (4) ($-R^2_{j,t,eq(4)}$). *Conservatism* is computed as $-(\beta_{1,j} + \beta_{2,j})/\beta_{1,j}$. This index captures the extent to which bad news is incorporated into earnings compared to good news.

We measure value relevance from the following regression:

$$RET_{j,t} = \delta_{0,j} + \delta_{1,j}EARN_{j,t} + \delta_{2,j}\Delta EARN_{j,t} + \zeta j,t \tag{5}$$

where $\Delta EARN_{j,t}$ is the change in firm *j*'s *NIBE* in year *t*, scaled by market value at the end of year $t-1$, and other variable are as defined above. We use the negative of the adjusted R^2 from Equation (5) to capture *Value Relevance* ($-R^2_{j,t,eq(5)}$).

Similar to Francis et al. (2004), we define *Smoothness* as the ration of firm *j*'s standard deviation of *NIBE* divided by beginning total assets, to its standard deviation of cash flows from operations divided by its beginning total assets [$\sigma(NIBE_{j,t})/\sigma\,(CFO_{j,t})$].

Persistence is measured as the negative of the slope coefficient estimate, $\varphi_{1,t}$, from an auto-regressive model of annual split-adjusted earnings per share ($X_{j,t}$, measured as firm *j*'s *NIBE* in year *t* divided by the weighted average number of outstanding shares during year *t*). The regression specification is as follows:

$$X_{j,t} = \varphi_{0,t} + \varphi_{1,t}X_{j,t-1} + v_{j,t}. \tag{6}$$

Finally, we compute a measure of accrual quality using the model of Dechow and Dichev (2002). *Accrual Quality* is the standard deviation of the residual from the following regression:

$$TA_{j,t} = \pi_{0,j} + \pi_{1,j}CFO_{j,t-1} + \pi_{2,j}CFO_{j,t} + \pi_{3,j}CFO_{j,t+1} + \xi_{j,t} \tag{7}$$

where *TA* is total accruals is defined earlier, and *CFO* is operating cash flows. All variables in Equation (7) are deflated by beginning total assets. We estimate Equation (7) separately for each firm and compute $\sigma(\xi_{j,t})$ as our measure of *Accrual Quality*.

The adjusted R^2 for our governance indices with these six measures are as follows: *Conservatism* (−0.84 percent), *Value Relevance* (0.24 percent), *Timeliness* (1.26 percent), *Persistence* (2.86 percent), *Smoothness* (5.19 percent), and *Accruals Quality* (22.71 percent). Despite the relatively high adjusted R^2s for several of these alternative measures it is important to examine the source of this explanatory power. There is a very mixed set of associations between our 14 governance factors and these six additional measures. In the interests of brevity, we briefly summarize these associations rather than tabulating the results.

None of the 14 governance factors are statistically significant in explaining conservatism. Affiliated is associated with lower value relevance, but Old Directors are associated with higher value relevance. Compensation Mix and Board Size are both associated with smoother net income relative to cash flows. Insider Appointed boards and Old Directors are associated with more persistent earnings and meeting frequency and Debt presence are associated with less persistent earnings. Affiliated is associated with less timely earnings, but Old Directors and Active are associated with more timely earnings. Finally, for accruals quality we found very mixed results: Active, Affiliated, Compensation Mix, and Debt exhibit expected signs, but Insider Appointed, Meetings, Anti-Takeover I, Insider Power, and Board Size exhibit unexpected signs. Consistent with the results in Table 5, there is very mixed evidence that our governance factors explain variation across numerous measures of financial reporting quality.

Earnings Restatements

Earnings Restatements, Control Variables, and Prior Literature

Earnings restatements are often claimed to be the result of weak governance and there has been considerable accounting and finance research recently examining the impact of various measures of governance on the likelihood of observing earnings restatements or fraud (e.g., Farber [2004] with board and audit committee characteristics; Dechow et al. 1996; Beasley [1996] with measures of board characteristics, blockholders, and CEO duality; Peng and Roell 2006; Erickson et al. [2006] for measures of executive compensation). We reexamine these findings with a sample of earnings restatements across our broad set of governance indices.[21]

We obtain data on earnings restatements from Huron Consulting (both 10-Q and 10-K restatements that are identified through amended SEC filings). We use an indicator variable, *Earnings Restatement*, which we set equal to 1 if the firm reports an earnings restatement related to the fiscal year (or a subsequent fiscal period) for which we have governance data, and 0 otherwise. For example, firm XYZ has a December 31, 2002 fiscal year-end. If XYZ restates its earnings for any of the fiscal periods from January 1, 2002 onward, then the *Earnings Restatement* is set equal to 1. For other firms the indicator variable is set equal to 0 with the exception that firms that restate earnings in an earlier fiscal period are dropped from the analysis. For example, if firm XYZ had a restatement prior to January 1, 2002, then we exclude that observation from our analysis. This leaves us with a sample of 2,094 firms of which 118 restate earnings. We exclude the restatements prior to January 1, 2002 because we cannot be sure that the governance structures we measure have changed in response to the restatement.[22]

Prior research has examined the prediction and the economic consequences of earnings restatements and SEC enforcement actions (e.g., Dechow et al. 1996). We incorporate the findings of this prior research to select our control variables that include *BM* (book-to-market, defined above), *Leverage* (calculated as total debt (item 9 + item 34) divided by total assets (item 6)), *External Financing* (calculated as net equity financing, item 108

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[21] In concurrent research, Baber et al. (2006) find very little evidence of relations between various governance measures and a sample of restatements reported by the General Accounting Office.

[22] It is possible that some of our restatements are "innocuous." To address this issue we identified the first mention of the earnings restatement in the media (typically this is announced via an 8-K filing in the current regulatory environment). We flag a restatement as "severe" if the market price drops by more than 3 percent around the announcement (three- or five-day announcement period). For this subsample of severe restatements we find very similar result to those tabulated (i.e., our 14 governance factors are not able to successfully identify restatement firms).

− item 115 − item 127, plus net debt financing, item 111 − item 114 + item 301, all deflated by beginning market value of equity), Log of market value of common equity (*Log*(*Market Cap.*)), *Free Cash Flow* (measured as the difference between operating cash flows, item 308, and average capital expenditures over the 3 prior years, item 128), and *Acquisitions* (calculated as total cash spent on acquisitions during the fiscal period restated, item 129, deflated by beginning market value of equity). *BM*, *Leverage*, and *Log*(*Market Cap*) are all measured prior to the fiscal period that is restated. All control variables are winsorized at the 2nd and 98th percentiles.

Earnings Restatements and Governance Factors

In our analysis of restatements, we exclude Meetings because the board could be meeting more frequently due to the upcoming earnings restatement. The results in Table 6 indicate that Debt and Insider Power are the only two governance factors that are associated with the likelihood of earnings restatements (pseudo-R^2 is 1.8 percent). When we include the control variables, Debt and Insider Power are still the only two governance factors that are associated with the likelihood of earnings restatements. In both specifications, Debt is positively associated with the likelihood of observing a restatement (opposite of our expectation) and Insider Power has the expected positive sign. The control variables contribute an additional 1.1 percent pseudo-R^2 to the explanatory power beyond the governance factors, whereas governance factors contribute an additional 2 percent pseudo-R^2 beyond the control variables. Since the dependent variable is dichotomous, we also report "hit rates" (or the percentage of cases that are correctly classified) for five cut-off probabilities (0.1, 0.2, 0.3, 0.4, and 0.5). As might be expected in a setting where the non-restating sample is much larger than the restating sample, the logistic model accurately classifies non-restatement observations, but the classification accuracy for the restatement observations is quite poor. Overall, the results in Table 6 provide little evidence that corporate governance has an impact on accounting restatements.

Future Operating Performance

Future Operating Performance, Control Variables, and Prior Literature

One way to assess the impact of governance structures on firm value is to examine an accounting based measure of future operating performance. For example, Gompers et al. (2003) find evidence that governance has a positive association with various measures of future accounting performance. Similar to prior research, we use return on assets (calculated as operating income, Compustat item 178, deflated by average total assets) as our measure of operating performance (ROA). Unfortunately, there is not a well-defined and accepted model of expected operating performance. Prior research has shown that measures of operating performance are very persistent (e.g., Penman 1992; Fama and French 2000). Thus, the natural candidate for expected future operating performance is current operating performance. However, to the extent that governance structures are stable over time and these factors determine the operating, investing and financing activities of the firm, the inclusion of current operating performance is likely to remove the impact of governance that we are trying to estimate. Rather than using current ROA as an expectation model for future performance, we use industry affiliation and firm size for our benchmark (e.g., Gompers et al. 2003; Core et al. 2006). We use the *Log* (*Market Cap.*) as our measure of firm size and the median two-digit industry ROA as our measure of industry performance. Industry-adjusted ROA is computed by subtracting the median industry ROA from the firm ROA.

TABLE 6
Relation between Earnings Restatements and Governance Factors

$Restatement_t = \alpha + \Sigma\varphi Controls_t + \Sigma\beta Governance\ Factors_t + \varepsilon_t$

		Logistic Regression				Recursive Partitioning	
Variable	**Pred. Sign**	**Governance Only Specification**		**Governance and Controls Specification**		**Governance Only Specification**	**Governance and Controls Specification**
Governance		Coef. Est.	χ^2	Coef. Est.	χ^2		
Intercept		−2.867	841.28***	−3.411	30.58***		
Active	−	−0.145	1.12	−0.238	1.98		
Block	−	0.040	0.14	0.089	0.67		
Affiliated	+	−0.135	0.84	−0.154	1.07		
Insider Appointed	+	−0.136	1.23	−0.128	1.08		Linear (−)
Compensation Mix	+/?	−0.020	0.03	0.059	0.25		
Meetings	NA	NA	NA	NA	NA	NA	NA
Lead Director	−	0.080	0.30	0.087	0.36		
Anti-Takeover I	+	0.117	0.54	0.109	0.46		
Old Directors	+	−0.194	1.25	−0.191	1.23		
Debt	−	0.185	4.93**	0.171	4.04**	Linear (+)	Linear (+)
Insider Power	+	0.290	4.24**	0.277	3.75*		Nonlinear
Board Size	+	0.079	0.38	0.020	0.02	Linear (−)	
Anti-Takeover II	+	−0.072	0.30	−0.059	0.20		
Busy Directors	+	0.147	0.94	0.101	0.42		
Controls							
BM	−			−0.317	2.41		Nonlinear
Log (Market Cap.)	+			0.102	1.50		
External Financing	+			0.188	0.13		
Acquisitions	+			0.757	0.30		
Free Cash Flow	+			−0.584	1.29		
Sample Size		2,094		2,094		2,094	2,094
Pseudo-R^2 Governance Factors Only		1.8%				NA	

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TABLE 6 (continued)

Variable	Pred. Sign	Logistic Regression: Governance Only Specification	Logistic Regression: Governance and Controls Specification	Recursive Partitioning: Governance Only Specification	Recursive Partitioning: Governance and Controls Specification
Incremental Pseudo-R^2 from Controls			1.1%		NA
Incremental Pseudo-R^2 from Governance Factors			2.0%		NA

Cut-Off Value	**0.10**	**0.20**	**0.30**	**0.40**	**0.50**
Hit Rates for Correctly Classifying the Occurrence of Restatements					
Economic determinants	0.8%	0%	0%	0%	0%
Governance only	6.8%	0.8%	0%	0%	0%
Full	10.2%	1.7%	0%	0%	0%
Hit Rates for Correctly Classifying the Absence of Restatements					
Economic determinants	100%	100%	100%	100%	100%
Governance only	98.1%	99.7%	100%	100%	100%
Full	96.5%	99.6%	100%	100%	100%

(continued on next page)

TABLE 6 (continued)

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*,**,*** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed tests) for the logistic regression specifications.

For the recursive partitioning analysis we report only those governance factors that were significant ($p < 0.05$, two-tailed) and note whether the relation was linear or nonlinear. If linear, we also note the sign of the relation.

Restatement = indicator variable equal to 1 if the firm reports an earnings restatement related to the fiscal year (or a subsequent fiscal period) for which we have governance data, and 0 otherwise:

For example, firm XYZ has a December 31, 2002 fiscal year end. If XYZ restates its earnings for any of the fiscal periods from January 1, 2002 onward Earnings Restatement = 1. Firms that restate earnings in an earlier fiscal period are dropped from the analysis. For example, if firm XYZ had a restatement prior to January 1, 2002 we exclude that observation from our analysis. This leaves us with a sample of 2,095 firms of which 118 restate earnings. We exclude earlier restatements because we cannot be sure that the governance structures we measure have changed in response to the restatement.

Control variables include:

BM (book-to-market) = book value of common equity (Compustat data item 60) divided by the market value of common equity (item 25 * item 199);
External Financing = total net external financing from debtholders and shareholders during the fiscal period that was restated (calculated as net equity financing, item 108 - item 115 − item 127, plus net debt financing, item 111 − item 114 + item 301, all deflated by beginning market value of equity);
Log (*Market Cap.*) = measured as the natural logarithm of market value of common equity;
Free Cash Flow = measured as the difference between operating cash flows, item 308, and average capital expenditures over the 3 prior years, item 128); and
Acquisitions = total cash spent on acquisitions during the fiscal period restated, item 129, deflated by beginning market value of equity.

BM and *Log* (*Market Cap.*) are measured prior to the fiscal period which is restated. All control variables are winsorized at the extreme two percentiles (i.e., values less (greater) than the 2nd (98th) percentile are set equal to the value of the 2nd (98th) percentile). Note that Meetings is excluded from the set of governance factors in these regression analyses because the number of meetings is influenced by the restatement in the period it is discovered/announced.

Future Operating Performance and Governance Factors

The results for future operating performance analysis are presented in Table 7. In the governance factors only specification, we find that Active, Compensation Mix, Insider Power, Board Size, and Anti-Takeover II have a positive association, whereas Anti-Takeover I and Debt have a negative association with future operating performance. The adjusted R^2 for this specification is 14.2 percent. However, it is important to note that this level of explanatory power includes four factors that have unexpected signs (Debt, Insider Power, Board Size, and Anti-Takeover II).[23]

One potential problem with the specification that only includes governance variables is that the implicit benchmark for ROA is simply the mean ROA across the sample of observations. A potentially more sophisticated benchmark may be produced when we control for industry and *Log (Market Cap.)*. In this expanded specification, we find that Block, Compensation Mix, and Anti-Takeover II are positively associated with future ROA, and Board Size and Busy Directors are negatively associated with ROA. With the exception of Anti-Takeover II, each of these governance factors has the expected sign. The inclusion of the control variables increases the explanatory power by an additional 5.9 percent, whereas the inclusion of the governance variables to the model that only includes controls increases the explanatory power by 4.7 percent.[24] Given the fairly large number of statistically significant governance indices with expected signs and the moderate level of explanatory power associated with these indices, we interpret the results as indicating a statistical and substantive association between corporate governance and future operating performance.

Future Stock Returns

Future Stock Returns, Control Variables, and Prior Literature

Our final dependent variable is excess stock returns, *Alpha*. Specifically, for each firm in our sample we obtain monthly stock returns (RET) from the CRSP files from the first month of the 2003 fiscal year through to December 2004. For example, for a firm with a December 31, 2002 year end, our returns cover the January 2003 to December 2004 period. These monthly returns are regressed on the standard Fama-French monthly factor returns (MKT, SMB, HML, and UMD). The intercept from the following regression (estimated at the firm level) is our estimate of future excess returns:

$$RET_t = \alpha + \beta_{MKT}MKT_t + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{UMD}UMD_t + \varepsilon_t$$

Since the dependent variable, *Alpha*, is excess returns, we do not include any additional control variables in the subsequent regression estimation. Our analysis of future abnormal

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[23] The sign on Compensation Mix is somewhat ambiguous when future operating performance is the outcome variable. We assume that "bad" governance is increasing in Compensation Mix (more accounting-based compensation and less stock-based compensation). However, if an executive is paid based on accounting performance, we would expect the executive to take actions to increase accounting performance (perhaps at the cost of decreasing stock price). Thus, our expectation for the sign of Compensation Mix is positive when operating performance is the outcome variable.

[24] We use different samples for the results tabulated in Table 7 for the governance only, controls only, and governance and controls specifications, due to data availability of the necessary variables. Therefore, the tabulated R^2s are not directly comparable. When we use the same sample for all three specifications, the R^2 of the governance and controls specification is 20.5 percent. The incremental R^2 by including the control (governance) variables is 5.0 percent (4.9 percent).

TABLE 7
Relation between Future Operating Performance and Governance Factors

$ROA_{t+1} = \alpha + \Sigma\varphi Controls_t + \Sigma\beta Governance\ Factors_t + \varepsilon_t$

		Ordinary Least Squares				Recursive Partitioning	
		ROA_{t+1}		Industry Adjusted ROA_{t+1}		ROA_{t+1}	Industry Adjusted ROA_{t+1}
Variable	**Pred. Sign**	**Governance Only Specification**		**Governance and Controls Specification**		**Governance and Controls Specification**	**Governance and Controls Specification**
Governance		Coef. Est.	t-statistic	Coef. Est.	t-statistic		
Intercept		0.037	12.30***	−0.271	−15.40***		
Active	+	0.062	14.02***	0.004	0.77	Linear (+)	Linear (+)
Block	+	0.002	0.56	0.010	3.03***		
Affiliated	−	−0.004	−0.92	−0.004	−1.06		
Insider Appointed	−	−0.003	−0.85	−0.003	−0.80		
Compensation Mix	+/?	0.032	8.74***	0.025	7.63***	Linear (+)	Linear (+)
Meetings	+	−0.005	−1.04	−0.003	−0.66		
Lead Director	+	0.000	−0.09	0.003	0.76		
Anti-Takeover I	−	−0.019	−3.82***	−0.007	−1.44		
Old Directors	−	0.005	1.00	0.004	0.94		
Debt	+	−0.012	−2.96***	−0.001	−0.35	Linear (−)	Linear (−)
Insider Power	−	0.012	2.45**	0.006	1.26		
Board Size	−	0.012	2.82***	−0.008	−1.92*		
Anti-Takeover II	−	0.007	1.68*	0.007	1.93*		
Busy Directors	−	−0.005	−1.05	−0.023	−4.88***		

(continued on next page)

TABLE 7 (continued)

		Ordinary Least Squares		Recursive Partitioning	
		ROA_{t+1}	Industry Adjusted ROA_{t+1}	ROA_{t+1}	Industry Adjusted ROA_{t+1}
Variable	**Pred. Sign**	**Governance Only Specification**	**Governance and Controls Specification**	**Governance and Controls Specification**	**Governance and Controls Specification**
Controls					
Log (*Market Cap.*)		NA	0.400 14.72***		
Sample Size		2,060	2,007	2,060	2,007
R^2 (Adj. R^2) Governance Factors Only		14.8% (14.2%)		16.18%	
Incremental R^2 from Controls			5.9%		12.27%
Incremental R^2 from Governance Factors			4.7%		6.63%

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*,**,*** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed tests) for the regression specifications.

For the recursive partitioning analysis we report only those governance factors that were significant ($p < 0.05$, two-tailed) and note whether the relation was linear or nonlinear. If linear, we also note the sign of the relation.

ROA (return on assets) = calculated as income before extraordinary items (Compustat data item 178) scaled by average total assets.

Control variables for the operating performance regressions include *Log (Market Cap.)*, measured as the natural logarithm of market value of common equity at the start of the fiscal period, and industry-adjusted *ROA* (using the median *ROA* for each two-digit SIC code with at least 5 firms).

stock returns rests on an assumption about market efficiency. If stock prices incorporate beliefs about the potential benefit of certain governance structures, then we should observe no association between our governance factors and future excess stock returns. For governance structures to be related to future excess returns it must be through either (1) inefficiency in the ability of market participants to price the associated benefits/costs or (2) systematic unexpected shocks to operating performance from these governance structures. Gompers et al. (2003) examine the relation between a set of anti-takeover provisions and excess returns for a sample of S&P 1500 firms during the 1990s and find higher future excess stock returns for "democracy" firms that have fewer anti-takeover provisions. Further work by Bebchuk and Cohen (2005) suggest that this relation is, in large part, due to staggered boards that are created by corporate charter. While Gompers et al. (2003) are careful to note that the association between anti-takeover provisions and stock returns is not suggestive of a trading strategy, subsequent research has challenged both the strength of this relation and the interpretation. For example, Cremers and Nair (2005) find that the impact of governance is very sensitive to the threshold cutoff used to classify firms into "democracy" and "dictator" groups. Core et al. (2006) find very little evidence to suggest that the relation is attributable to unexpected performance shocks, raising the possibility that the relation may be indicative of a market misunderstanding of the importance of governance structures. In fact, Bebchuk et al. (2006) suggest that the importance of poison pills changed significantly during the earlier part of the 1990s and this had consequences for firm valuations.

Future Stock Price Performance and Governance Factors

Table 8 reports our regression analysis for future excess stock returns. In our regression analysis we find that Insider Appointed, Compensation Mix, Lead Director, Debt, and Insider Power are significantly associated with *Alpha*. Of these, Lead Director, and Insider Power are significant in the predicted direction. The adjusted R^2 is 2.0 percent and is similar to the explanatory power of other studies that use excess stock returns as the dependent variable (e.g., Sloan 1996). Overall, we find some evidence that a subset of our corporate governance indices is associated with future excess returns.

V. EXTENSIONS AND SENSITIVITY ANALYSES

Exploratory Recursive Partitioning Analyses

One problem with the traditional regression approach is that a simple linear structure cannot capture the likely complex nonlinearities and interactions among the independent variables. Absent clear theory, interactions are exceedingly difficult to theoretically specify and tend to produce high levels of multi-collinearity between the main effects and interaction variables. As an alternative methodological approach, we also analyze our data with exploratory recursive partitioning using the well-known CHAID (or Chi-square Automatic Interaction Detection) algorithm (e.g., Kass 1980; Biggs et al. 1991).

Recursive partitioning models are constructed by successively splitting the data into increasingly homogeneous subsets. At each step, the independent variables are examined and the one that gives the "best" split is selected. The splitting process is terminated based on selected traditional "stopping rules." Recursive partitioning ultimately produces a

TABLE 8
Relation between Future Stock Returns and Governance Factors

$$Alpha_t = \alpha + \Sigma\beta Governance\ Factors_t + \varepsilon_t$$

		Ordinary Least Squares		Recursive Partitioning
Variable	**Pred. Sign**	**Governance Only Specification**		**Governance Only Specification**
Governance		Coef. Est.	t-statistic	
Intercept		−0.002	−2.34**	
Active	+	0.001	0.07	
Block	+	0.000	0.52	Nonlinear
Affiliated	−	0.000	0.40	
Insider Appointed	−	0.002	1.91*	Linear (+)
Compensation Mix	−/?	0.004	4.25***	Linear (+)
Meetings	+	0.001	0.66	
Lead Director	+	0.004	3.24***	Linear (+)
Anti-Takeover I	−	−0.002	−1.31	
Old Directors	−	0.001	0.42	
Debt	+	−0.003	−2.82***	
Insider Power	−	−0.004	−2.90***	
Board Size	−	0.002	1.50	
Anti-Takeover II	−	0.000	0.28	
Busy Directors	−	0.001	0.37	
Controls				
NA				
Sample Size		2,066		2,066
R^2 Governance Factors Only		2.0%		2.72%

*,**,*** Indicates significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed tests) for the regression specifications.

For the recursive partitioning analysis we report only those governance factors that were significant ($p < 0.05$, two-tailed) and note whether the relation was linear or nonlinear. If linear, we also note the sign of the relation.

Alpha = intercept from a regression of monthly firm excess returns (excess over the risk free rate) on the monthly factor returns (MKT, SMB, HML, and UMD). The factor returns are obtained from Ken French's website. For each firm we use up to 24 months of return data to generate *Alpha.*

tree-like structure that allows nonlinear and interactive associations between the dependent variable and a set of independent variables.[25]

Although recursive partitioning has a more exploratory nature than traditional econometric approaches, it is important to use multiple analysis methodologies for complex research problems in order to insure that the results are not simply due to method variance. We describe the results of the recursive partitioning analysis in detail for the directional abnormal accrual variable, but for the sake of brevity, we summarize the recursive partitioning results for our other outcome variables alongside the OLS and logistic results in Tables 5–8.

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[25] Another advantage of recursive partitioning is that it is more straightforward to uncover whether governance constructs appear to be complements or substitutes for explaining the dependent variable. Prior research has attempted to look at such complementarities across governance structures in a variety of settings. Examples include Brickley et al. (1994), Malette and Fowler (1992), Sundaramurthy et al. (1997) who find board characteristics relate to the adoption of anti-takeover devices, and Conyon and Florou (2006) who find that CEO compensation and stock holding of directors impacts investment decisions made by managers close to retirement age.

The recursive partitioning results for the absolute value of abnormal accruals are presented in Figure 1 (and summarized in the last column of Table 5). Recursive partitioning analysis yields somewhat stronger explanatory power (R^2 = 7.17 percent). This is not surprising given that recursive partitioning allows nonlinear and interactive associations between the dependent variable and a set of independent variables. As illustrated in Figure 1, Board Size is an important governance factor in explaining nondirectional abnormal accruals (level one in Figure 1). This is the first variable in the partitioning and the decision model brings out the interactions between the variables in the lower levels of the diagram. In contrast to our expectations, we find that nondirectional abnormal accruals are lower for companies that have larger boards.

For companies that have small boards, we find that Block becomes important (level two of Figure 1). However, the relation between blockholders and nondirectional accruals in this subsample is nonlinear. For companies with large boards, Debt becomes important (level two of Figure 1). We find the expected inverse relation between nondirectional accruals and Debt for this subsample. Finally, for the subsample of firms with large boards and high debt, board size again becomes significant. However, similar to the level one result, board size does not exhibit the expected sign at level three.[26]

The recursive partitioning results for nondirectional accruals are only marginally consistent with the regression estimates in Table 5 (Panel B). The only factor that is consistent across the OLS and recursive partitioning results is Debt. Similar inconsistent results are also found for the directional accruals (Table 5, Panel A). The disparity in results from the two methodological approaches is further evidence that the association between our governance factors and accounting accruals is weak. An additional insight from the recursive partitioning is that the largest (smallest) nondirectional abnormal accruals are observed for firms with small boards and low ownership by blockholders (firms with large boards and high levels of debt). Although these interactions are based on purely exploratory analysis, it would be interesting to explore the nature of complements or substitutes across governance factors in future research.[27]

The recursive partitioning analysis for accounting restatements (Table 6) reveals that Debt and Board Size are the two significant governance indices in the governance only specification. However, both variables exhibit signs opposite to our expectations. When we include the control variables, Insider Appointed (Debt) has an unexpected negative (positive) association with restatement, and Insider Power has a nonlinear association with restatements. Similar to the logistic regression results, the recursive partitioning analysis finds virtually no evidence that restatements are associated with corporate governance.

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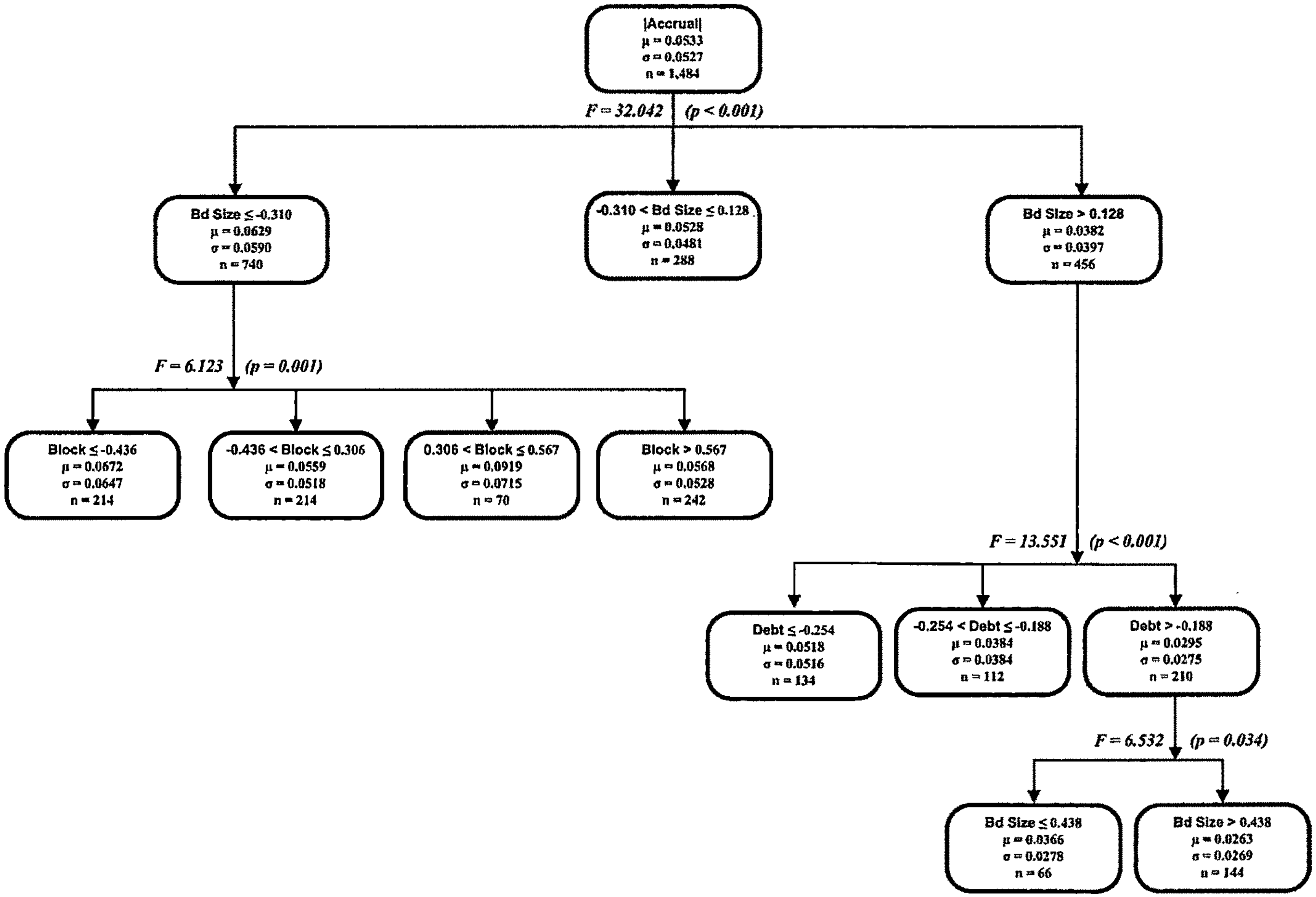
[26] It is important to highlight that regression analysis assumes that the *same* model is applicable to the entire sample of firms, whereas the recursive partitioning identifies a specific set of explanatory variables for each subsample. For example, Block (Debt) is only relevant for 740 (456) of the total sample of 1,484 firms.

[27] The R^2s from our recursive partitioning analysis for the various alternative measures of financial report quality are as follows: for conservatism (0.00 percent), timeliness (2.99 percent), smoothness (5.70 percent), persistence (4.49 percent), value relevance (0.00 percent) and accrual quality (14.20 percent). Old Directors and Anti-Takeover II are statistically significant for timeliness, but both variables have unexpected signs. Board Size and Anti-Takeover II are statistically significant for timeliness, but both variables have unexpected signs. Debt is statistically significant for persistence, but this variable has an unexpected sign. Active, Debt, Board Size, and Compensation Mix are statistically significant for accrual quality, but Board Size and Compensation Mix have unexpected signs. Finally, none of the governance indices are statistically significant for conservatism or value relevance.

FIGURE 1
Recursive Partitioning Analysis for the Absolute Value of Abnormal Accruals



The recursive partitioning analysis for future operating performance (with and without controls) is somewhat consistent with the previous regression results (Table 7). The explanatory power of the governance only specification is 16.2 percent with Active and Compensation Mix (Debt) being positively (negatively) associated with future ROA. Similar to the regression results, the sign for Debt is opposite to our expectation. While the results vary with the methodological approach, we find consistent evidence that Active and Compensation Mix have a statistical and substantive association with future operating performance.

Finally, the recursive partitioning results confirm some of the regression results for future excess returns (Table 8). The main differences are that Block is also significant (and has a nonlinear association), and Debt and Insider Power are no longer significant. Compensation Mix and Lead Director are again statistically associated with future excess stock price returns. The explanatory power from the recursive partitioning analysis is 2.7 percent.

Overall, the regression (and logistic) and recursive partitioning results are consistent for most outcome variables. This comparative evidence is important because it provides some evidence that our results are not completely confounded by method variance (i.e., whether methodologies produce substantively different results and interpretations). Nevertheless, the most appropriate methodological approach for examining the link between governance constructs and accounting outcomes and organizational performance is an unresolved econometric question.

Limited Sample Period

One potential problem with our analysis is that we use only one year of data and that time period coincides with significant regulatory reform (e.g., Sarbanes-Oxley Act and new exchange listing requirements). This observation raises some concern about the power of our statistical tests and the ability to generalize our results. To assess the impact of these regulatory changes, we obtained time-series data for various subsets of our governance measures and examined the change in these measures over time. It was not possible for us to examine all of the data obtained from Equilar Inc. and True Course Inc. because we only have the necessary data from 2002 onward. Instead, we examined other data sources to look at changes in a variety of governance structures from 1990 to early 2000.

Our first analysis examines the persistence of the governance index developed by Gompers et al. (2003). This index is comprised of 24 indicators reflecting the quality of shareholder rights and is increasing in the weakness of these rights. For the 649 firms that are covered on all seven IRRC reports (1990, 1993, 1995, 1998, 2000, 2002, and 2004) the mean index is very stable starting at 10.3 in 1990 and only slowly decreasing to 9.1 in 2004. Furthermore, the correlation over time between reports is 0.98. If we restrict our analysis to the 1,260 firms covered on the 2000, 2002, and 2004 IRRC reports, then the over-time correlation between 2000 and 2004 is 0.91 and between 2002 and 2004 is 0.97.[28] Since anti-takeover and shareholder rights provisions are very stable intertemporally, our results for similar variables should not be confounded with regulatory changes.

As a second analysis, we examined the persistence of various board-specific measures including the size of the board and audit and compensation committees, along with the composition of the board and those committees. This data is available from IRRC for the years 1996 to 2002 for the full board and from 1998 to 2002 for the various subcommittees of the board. For the sample of 733 firms that had data in all years, board size has remained very stable through time (the average board in 1996 had 10.7 directors and in 2002 this was 10.4 directors). The over-time correlation in board composition (i.e., the fraction of the board that is comprised of independent outside directors) is 0.85 and similar stability is found with the size and composition of both the audit and compensation committees. These results suggest that our analysis of board variables is not likely to be completely confounded by regulatory changes.

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[28] This result is perhaps not surprising given that a large number of the components of this governance index were set at the time a company was incorporated (e.g., super-majority requirements and staggered board classifications).

We also obtained analyst ratings of board effectiveness from The Corporate Library (TCL) for 1,504 firms in 2002, 1,712 firms in 2003, and 1,934 firms in 2004. The over-time rank correlation in the ratings is 0.93 between 2003 and 2004, suggesting that even qualitative assessments of governance quality are temporally stable in the most recent years. However, the over-time rank correlation between 2002 and 2003 is only 0.40. The low correlation for the TCL ratings from 2002 to 2003 is caused by a change in the algorithm that TCL used in generating their board effectiveness rating, rather than changes in the underlying structural indicators of governance (especially as our analysis above of the IRRC data of board structures and shareholder rights suggest that these measures are very stable year over year). Our conversations with TCL and other rating agencies (such as ISS and GMI) suggest that the algorithm used to generate overall ratings is modified in response to feedback from the analysts generating the reports. These modifications either alter the weight of subcategories of governance measures or change the set of included/excluded measures from year to year.[29]

Our analysis of the stability of governance measures is consistent with the recent study by Linck et al. (2005) that examines 6,931 corporate boards over the period 1990 to 2004. In general, they find that board structure has been surprisingly stable over the last 15 years. For example, the fraction of executive directors on a board has decreased from about 37 percent in 1990 to 34 percent in 2001 and about 31 percent in 2004. This decrease is not economically significant given that the mean board size over the period is about eight members. Linck et al. (2005) also find that board size has remained very stable at about eight directors for their full sample, and that the fraction of firms with a dual CEO-Chair has remained relatively constant at around 55 percent. Linck et al. (2005) do find evidence of increased director turnover around the Sarbanes-Oxley Act. However, it is important to note that most of the observable/structural indicators of governance (e.g., board composition, board size, and dual CEO-Chair) do not change.

Overall, the structural indicators of governance that are the focus of our empirical analysis have not changed significantly over time or around the Sarbanes-Oxley Act. Our analysis of governance data for the single time period from June 2002 to May 2003 is likely to be representative of earlier time periods. Furthermore, given that there is considerable cross-sectional variation in our governance measures during the period we examine, our statistical analyses are likely to have sufficient power to detect the association between measures of corporate governance and various accounting outcomes. We do, however, recognize that our sample period can be characterized by greater scrutiny from regulators and capital markets, and changing regulations and expectations from directors. If this increased monitoring has been pervasive across firms, then this will limit our ability to detect associations in the data.

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[29] We also obtained data from GovernanceMetrics International for the Standard & Poor's 500 firms in 2002, 2003 and 2004. The over time rank correlation between 2003 and 2004 is 0.63 and between 2002 and 2003 is 0.64.

Concerns about Endogeneity

Our methodological approach essentially involves assessing the relation between an accounting outcome variable and a set of choices for organizational structure (i.e., the governance constructs). Since the regressor variables are endogenous choice variables, the exogenous determinants of these choice variables are also likely to affect the outcome variable. If the determinants of the regressor (or right-hand-side) variables are not included in the statistical model being estimated, then the regressor variables are correlated with the true (but unobserved) error term in the equation. In this setting, ordinary least squares (or logistic) parameter estimates will be inconsistent due to the well-known correlated omitted variables problem. Most empirical accounting research is confounded to at least some degree by the endogenous nature of the predictors in the statistical model.[30]

The implication for archival corporate governance research is that it is very difficult to make causal inference from cross-sectional studies of these endogenously chosen governance characteristics and any outcome variable (e.g., Demsetz and Lehn 1985). An alternative perspective is that firms are dynamically learning and moving toward their optimal governance structure (i.e., most firms deviate from the optimal choice at a point in time). As discussed in Ittner et al. (2003), this implies that observed cross-sectional differences in governance structure provide a method for assessing the accounting and economic consequences of these factors. In order to implement this approach, we assume that firm size (measured as the natural logarithm of the market value of equity) and industrial classification (measured using two-digit SIC codes) are the two primary "exogenous" determinants of corporate governance. Thus, the residuals produced from a regression of each governance index on firm size and industry should be a measure of how far a firm deviates from the "optimal" governance structure. The key assumption for this approach to be valid is that the systematic part of the regression is the appropriate governance choice for the firm. If we find similar results after adjusting for the systematic part of governance choices, then this will suggest that the results in Tables 5 to 8 are not completely confounded by econometric problems induced by endogenous regressor variables.

We estimate the statistical association of each accounting outcome variable with a variable that takes on the value of the governance factor residual if it is positive and a value of zero otherwise, and another variable that takes on the value of the governance factor residual if is negative and a value of zero otherwise. We separate the residual into two variables in order to allow for a different impact of firms that have higher or lower governance than similar firms. For example, less governance relative to the benchmark may produce poor performance, but more governance than the benchmark may have no relation with performance. We estimate four regressions (one for each accounting outcome variable) with 28 variables for the 14 governance factors.

The results (not tabulated) for the accrual analysis again exhibit the very mixed outcomes and the restatement analysis provides virtually no evidence suggesting an association between corporate governance and accounting restatements. These results are very consistent with interpretations from the results in Tables 5 and 6. The analysis of future operating performance produces results similar to those in Table 7. One interesting outcome produced by this expanded analysis is that most of the negative residuals for the governance indices are statistically significant and have the expected sign. This indicates that operating performance is *lower* for firms that have governance that is *below* the structure implied by a benchmark derived from firm size and industry. Finally, the results for future excess stock price performance are also similar to those reported in Table 8. Thus, there is evidence consistent with a statistical and substantive association between corporate governance and future operating and stock price performance, but little systematic evidence for accounting manipulations. Moreover, these results do not appear to be completely confounded by the endogeneity of the corporate governance indices.

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[30] The standard textbook solution to endogeneity is to implement some type of instrumental variables estimation procedure. In particular, a set of variables that are assumed to be exogenous is selected and then n-stage least squares estimation is used to estimate the coefficients in the regression model. This solution to endogeneity works if the researcher can find instrumental variables that are correlated with the endogenous regressor, but uncorrelated with the error in the structural equation. In most applied settings, it is extremely difficult to identify such instrumental variables. Moreover, Larcker and Rusticus (2006) analytically and numerically show that ordinary least squares estimates typically exhibit better statistical properties than two-stage least squares estimates when the selected "instrumental variables" do not precisely conform to the textbook definition for instrumental variables (i.e., the instrumental variables are weak predictors of the endogenous variables and the instrumental variables are themselves partially endogenous). As a result, it will be difficult to use instrumental variable methods to address concerns about endogeneity in our setting.

VI. SUMMARY AND CONCLUSIONS

The relation between corporate governance and managerial behavior and organizational performance is of fundamental importance to practitioners, academics, and policy makers. Assumptions and strongly held beliefs about the importance of governance are shaping the current regulatory climate for the design of governance structures. However, a consistent set of results is yet to emerge from the academic literature. We suspect that these mixed results are partially the result of governance measures that have a very modest level of reliability and construct validity.

In this study, we develop a new set of indices from a comprehensive set of structural indicators of corporate governance. In order to mitigate measurement error and develop a parsimonious representation for the construct of corporate governance, we use principal component analysis and develop 14 multi-indicator indices from 39 individual governance indicators. These indices are an *initial* step in the process of developing reliable and valid indicators for the complex construct termed corporate governance. We then assess the ability of these indices to explain abnormal accruals, accounting restatements, future operating performance, and future stock returns. We find that our governance indices are related to future operating performance and excess stock returns. However, these indices have a very modest and mixed association with abnormal accruals and almost no relation with accounting restatements.

As with all somewhat exploratory studies, it is important to be explicit about the inherent limitations of our research. First, we only analyze a single year of data and this potentially restricts our ability to generalize to other periods. Although our data are current, the time period of data collection coincides with the Sarbanes-Oxley Act and changes in exchange listing requirements. If this regulatory change caused firms to adopt greater conformity in governance mechanisms, then this will reduce cross-sectional variation in our measures and decrease the power of our statistical tests. However, our analysis of other related governance data does not indicate substantial changes in structural measures of corporate governance in the time period surrounding the Sarbanes-Oxley Act. Thus, we believe that our statistical analysis has sufficient power to detect the association between corporate governance and accounting outcome measures.

Second, corporate governance choices are endogenous variables and this has the potential to produce a variety of serious econometric problems. Absent clear theory and the identification of strictly exogenous instruments, it is very difficult to appropriately incorporate the endogenous relations into our analysis. We attempt to mitigate concerns about endogeneity by using the governance residuals estimated using firm size and industry as predictor variables. Although this approach does not completely resolve concerns about endogeneity, this expanded analysis generates results that are similar to the results without any control for endogeneity.

Third, it may not be possible to capture the association between corporate governance and accounting outcomes using standard linear models. For example, a linear model cannot capture the likely complex nonlinearities and interactions among the independent variables. In order to assess the impact of method variance on our results, we also use exploratory recursive partitioning to analyze the association between corporate governance and accounting outcomes. The results are very similar for both linear model and recursive partitioning approaches, and we do not believe that our interpretations are affected by method variance.

Fourth, our empirical analysis may not adequately capture economic determinants of accounting outcomes, or even the accounting outcomes themselves. Furthermore, some of the key dimensions of the complex corporate governance construct may be missing from our analysis. Thus, our results are subject to the standard criticisms related to correlated omitted variables and measurement error. We have included virtually all variables from prior research that have been shown to be associated with each of our dependent variables, used the most contemporary measures for our outcome variables, and analyzed a very comprehensive set of governance indicators. Nevertheless, there is an unknown degree of measurement error and correlated omitted variable bias in our empirical results.

Fifth, despite a careful attempt to sample the domain of the corporate governance construct and assess the measurement properties of indices, we do *not* have perfect measures of corporate governance. Although this is a limitation, it is important to note that prior empirical work has provided almost no discussion of their selected measures (e.g., Gompers et al. 2003; Brown and Caylor 2006). Our paper is an initial attempt to develop measures of the construct that is termed corporate governance. Obviously, much measurement work remains to be done to develop reliable and valid measures that can subsequently be used by researchers.

Finally, similar to most prior work, our study primarily focuses on the number of statistically significant governance coefficients with the expected sign. While statistical significance is necessary, it is also crucial to demonstrate that the explanatory power of the predictor variables is large enough to draw substantive conclusions about corporate governance. Determining the minimum level of R^2 that must be exceeded before drawing substantive conclusions is complicated because this benchmark will vary with the complexity of the research question and the amount of prior research on a topic. However, given the strong substantive interpretations contained in most corporate governance research, it would be useful for researchers to begin a constructive debate regarding the role of explanatory power in this type of work.

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Do Cross-Border Listing Firms Manage Earnings or Seize a Window of Opportunity?

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ABSTRACT: Firms raising new equity capital at cross-listing (IPO) and those cross-listing existing home-country public shares (non-IPO) benefit from earnings that are high when they cross-list on U.S. stock exchanges. IPO firms have greater benefits than non-IPO firms because they receive cash infusion at listing. I find that performance (ROA) and cash flows peak at cross-listing period for all cross-border firms. Using a matched-firm research design to control for industry and performance, the results suggest that both IPO and non-IPO firms time cross-listing when performance is peaking (seize a window of opportunity). Further tests investigate whether IPO and non-IPO firms differ in their incentives to engage in earnings management at the time of cross-listing. The results suggest that both appear to engage in the same level of earnings management at the time of cross-listing. This suggests that incentives to boost earnings to obtain higher cash infusion are not the main motivation for the earnings management observed. Other incentives, such as greater investor recognition could be a stronger motivation.

Keywords: *cross-listing IPO; discretionary accruals; earnings management.*

I. INTRODUCTION

The recent literature on the globalization of capital markets has reported several benefits of cross-listing on U.S. stock exchanges.[1] Specifically, these benefits include (1) a more liquid market for foreign shares leading to lower bid-ask spreads, (2) an ability to raise capital at cheaper prices on a more efficient market, (3) broadening the shareholder base to diversify financial risk, and (4) an increase in prestige and investors' recognition of cross-listing firms. Merton (1987) demonstrates that variation in the levels

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[1] See the Geneva Group, Inc., the Bank of New York—the basics & benefits (http://www.adrbny.com/dr_edu_basics_and_benefits.jsp), JPMorgan ADR Group (http://www.adr.com), Bancel and Mittoo (2001) and Karolyi (1996, 1998) for detailed discussions of cross-listing benefits from financial press and academic literature.

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of investor recognition of a firm security influences stock prices. Lehavy and Sloan (2005) find that corporate events such as exchange listings increase investor recognition of a firm. They document a positive association between investor recognition and contemporaneous stock returns. Bradshaw et al. (2006) report similar valuation benefits using analyst data. They find that analysts set higher prices for firms raising new financing, an event that increases investors' recognition and is also analogous to cross-listing. Similarly, Lang, Lins, and Miller (2003) find that firms cross-listing on U.S. exchanges have greater analyst coverage and increased market valuations. These benefits of cross-listing are likely to improve if firms time listing to a window of opportunity (period of high earnings) or manage earnings at the cross-listing period. Alford et al. (1993) and Lang et al. (2006) argue that firms are likely to manage earnings at the cross-listing period. Whether these firms manage earnings at cross-listing or cross-list in a window of opportunity is the subject of this paper.

The SEC is concerned about earnings management by cross-border firms and the potential for this practice to erode the integrity of the financial reporting system (Breeden 1994; Levitt 1998). The SEC operates from the premise that home-country or other generally acceptable accounting principles (GAAP) produce less transparent financial reporting than U.S. GAAP.[2] For this reason, the commission requires non-IPO filers to reconcile their financial statements into U.S. GAAP in Form 20-F, Item 17.[3] Evidence from Reese and Weisbach (2001) and Lang et al. (2006) suggests that reporting less transparently creates an opportunity for foreign firms to manage earnings. Based on these concerns, the SEC requires firms issuing an IPO at the time of cross-listing to comply with U.S. GAAP and Regulation S-X in Form 20-F, Item 18. The Committee of European Securities Regulators (CESR) considers International Financial Reporting Standards (IFRS) a U.S. GAAP equivalent. CESR disagrees with both the Item 18 requirements and the mandated reconciliation required in Item 17 for cross-listing existing home-country shares.[4] The differing positions of the SEC and CESR highlight the importance of understanding the effects of their policies on earnings management at cross-border listing. Because the SEC demands more accounting transparency from IPO firms than from non-IPO firms, the former may have a limited opportunity to manage earnings at the cross-border year. Frost and Kinney (1996) report that foreign firms are reluctant to comply with the more-transparent Item 18 for fear that they might reveal aggressive revenue recognition, hidden reserves, or a substantially underfunded pension plan.

This study investigates two interesting predictions: Do firms time their cross-listing in a window of opportunity when earnings are peaking or do they manage earnings to make themselves look better at the time of listing? The first set of tests combines all cross-listing firms, while the second tests examine whether IPO and non-IPO subsamples of cross-listing firms are different. In contrast to my research predictions and focus, Lang, Ready, and Yetman (2003) examine the characteristics of earnings for cross-border firms relative to foreign firms not cross-listing in U.S. markets, while Lang et al. (2006) investigate whether cross-border firms manage earnings toward a target based on their proportion of small positive earnings. I extend previous research (Lang, Lins, and Miller 2003; Lang, Ready, and Yetman 2003; Lang et al. 2006) by partitioning the cross-listing sample into IPO and non-IPO subsamples, a key innovation of the current research design. This research design feature allows me to control potential effects of reporting transparency and cash infusion from equity offering at cross-listing on firms' incentives to manage earnings. Cross-border IPO firms raise new equity capital for the first time in the U.S. public market at cross-listing. The NYSE and Nasdaq classified these firms as IPO with respect to U.S. markets. The non-IPO cross-border firms list existing home-country public market shares on a U.S. market.

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[2] Sutton, Chief Accountant of the SEC, indicated that acceptance of home-GAAP for cross-border listing depends on its reporting transparency and how well it measures up with U.S. GAAP (see Harris and Muller 1999; Ndubizu and Sanchez 2006). Pownall and Schipper (1999) report that the SEC treats home-country GAAPs as substandard to U.S. GAAP, with lower comparability, transparency, and full disclosure. Meek and Thomas (2004) point out that U.S. GAAP is more transparent and has more onerous disclosure requirements relative to other GAAPs. Alford et al. (1993) report that the SEC is concerned about cross-border firms using non-U.S. GAAP to manage earnings.

[3] Form 20-F Item 17 allows financial statements to be prepared using home-country GAAPs or a comprehensive body of accounting principles, quantifying and reconciling material variations from U.S. GAAP and Regulation S-X.

[4] See http://www.cesr-eu.org for the April 27, 2005 press release from the Committee of European Securities Regulators recommendation. The CESR finds that reconciliation to U.S. GAAP as mandated by the SEC is unnecessary.

Exhibit 1 compares IPO and non-IPO subsamples together with U.S. domestic IPO firms to provide deeper insight into the underlying differences between the groups and their implications for earnings management incentives. The comparison is based on (1) number of public shares before listing, (2) infusion of cash at listing, (3) reporting GAAP, (4) flexibility of GAAP to manipulate earnings, (5) incentives to manage earnings, (6) incentives to list in a window of opportunity, (7) investor recognition incentives, (8) incentives to maximize share prices, and (9) average minimum new shares at listing. The above dimensions for comparison are analyzed in terms of their impacts on firms' incentives to manage earnings. The comparative analysis shows that IPO and non-IPO firms are different. Because only IPO firms receive a cash infusion at listing, I argue that they have stronger incentives than non-IPO firms to manage earnings, list in a window of opportunity, and maximize share prices and cash infusion by seeking higher levels of investor recognition at listing. If the test results are indistinguishable between IPO and non-IPO subsamples, then the differences identified in Exhibit 1 are not as important as cross-listing per se in the empirical research setting.

I report three primary results. First, I find that cross-border firms have significant ROA, cash flows, and working capital accruals that peak in the listing period (years −1 to 0) and fall in subsequent years (years 1 to 2). The listing period performance, cash flows, and accruals are significantly higher than in later years (years 1 and 2). Because listing-period ROA and cash flows are both high, cross-border firms could be either timing their listings or managing earnings. I then investigate whether they engage in earnings management. If cross-border firms manage earnings, then it would seem reasonable to assume that they would use the flexibility offered by accruals to achieve their goal. For this reason, I examine descriptive statistics on discretionary accruals as well as numerous specifications of discretionary accruals by estimating the modified Jones model. The results indicate that discretionary accruals are significantly higher at cross-listing period than they are in later years. This result supports earnings management.

Second, to provide further evidence in support of earnings management, I use a matched-firm research design to control for performance, industry, and U.S. stock exchange listing. Because cross-border firms face U.S. information environments and their decisions to cross-list are not directly associated with home-country reporting, I compare them to matched control U.S. firms. I find that the differences in pre-listing year (−2) ROA, cash flows, accruals, working capital accruals, and discretionary accruals are insignificant between cross-border and matched firms. However, cross-border firms have significantly higher discretionary accruals in listing years than the matched firms. Therefore, adjusting for performance, cross-border firms appear to manage earnings at a rate higher than matched

EXHIBIT 1

Differences between U.S. IPO, Cross-Listed IPO, and Cross-Listed Non-IPO Firms

Dimensions of Comparison[a]	U.S. IPO Domestic Firms[b]	Cross-Listed IPO[c]	Cross-Listed Non-IPO[d]
Public shares before listing	No	No	Yes
Infusion of cash at listing	Yes	Yes	No
Reporting rules and disclosures	U.S. GAAP	U.S. GAAP	Other GAAP
Flexibility to manipulate earnings	Weaker	Weaker	Stronger
Incentives to manage earnings	Stronger	Stronger	Weaker
Incentives to list when performance is high	Stronger	Stronger	Weaker
Investor recognition incentives	Stronger	Stronger	Weaker
Incentives to maximize share price (cash)	Stronger	Stronger	Weaker
Average minimum new shares issued at listing	NYSE 1.1m/$40m NASD 1.1m/$20m	NYSE2.5m/$100m NASD1.1m/$20m	NYSE 0 NASD 0

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[a] IPO firms and non-IPO firms are compared based on the following dimensions: public shares before listing; infusion of cash at listing through issuance of initial public offerings (IPO); required accounting rules and disclosure; flexibility of required rules to manipulate earnings; firms incentives to manage earnings; firms' incentives to list when performance is high; firms' incentives to be recognized by investors; firms incentives to maximize share price and cash infusion; and average minimum new shares issued at listing. The minimum number of new public shares and market values are obtained from NYSE and Nasdaq for IPO domestic firms and cross-listed IPO firms. This represents the minimum threshold for each exchange. The data from NYSE indicate that the mean and median equity raised at cross-listing by non-U.S. IPO firms are $343 million and $180 million during 1995 to 2003. The PricewaterhouseCoopers IPO Watch (http://www.pwc.com/ustransactionservices) indicates that the number of domestic IPO rose to 54 in the second quarter of 2005 from 43 in the first quarter. However, proceeds fell to $9.3 billion from $10.8 billion in the first quarter, with an average offering of $250 million dollars. This average is higher than the minimum threshold reported in the exhibit for both exchanges. M = million.

[b] U.S. IPO firms are domestic firms.

[c] Cross-listed IPO firms are foreign firms that issued initial public offering at the time of cross-border listing. This group is referred to as IPO in the paper.

[d] Cross-listed non-IPO firms are foreign firms that cross-listed existing public shares at cross-border listing and are referred to as non-IPO firms.

control U.S. firms. These findings extend Lang, Ready, and Yetman (2003) and Lang et al. (2006) evidence that differences in managerial incentives and regulatory environments affect the characteristics of reported accounting data.

The final test investigates whether the high discretionary accruals are higher for firms raising new equity at cross-listing, which have incentives to issue capital at higher prices. In contrast to previous research that focused on cross-border samples, I compare IPO and non-IPO subsamples of cross-border firms. I find that both groups have similar cash flows, accruals, and discretionary accruals around their cross-listing years, with a peak in their listing years. The results indicate that IPO firms raising new capital have levels of discretionary accruals in listing years similar to those of non-IPO firms. Because their discretionary accruals are indistinguishable, this suggests that the observed earnings management is driven by cross-listing per se rather than incentives to receive cash at high stock prices. These results are of interest to global security market regulators and standards-setters engaged in developing and implementing cross-border accounting standards. The looser GAAP for non-IPO firms does not appear to result in more earnings management.

The remainder of the paper is organized as follows. Section II discusses relevant literature. Section III describes the data, sample selection, and accruals estimation procedures. Section IV presents empirical results. Section V draws conclusions and presents a summary.

II. RELEVANT LITERATURE

Recent studies find that firms manage earnings to obtain cheaper capital, to meet analysts' projections, to meet regulatory thresholds and to increase stock prices (Dechow and Skinner 2000; Healy and Wahlen 1999). Foreign firms interested in cross-border listing are especially sensitive to earnings volatility because they must have at least $100 ($20) million of market value in public shares to cross-list on the NYSE (Nasdaq).[5] The NYSE requires a minimum total pre-tax income of $100 million for the latest three fiscal years (up to and including the cross-border year) and at least $25 million of pre-tax income in the cross-listing year.[6] Biddle and Saudagaran (1992) find that the demanding listing threshold prevents firms from cross-listing on U.S. exchanges. Because cross-border listing provides significant economic benefits, including a more liquid market for foreign shares, raising capital at cheaper prices, broadening the shareholder base, and increasing investor recognition, managers have incentives to meet the cross-listing threshold of U.S. exchanges. This incentive is more pronounced for firms close to violating the market value or earnings cross-listing thresholds.

A number of recent studies indicate that the earnings reported by cross-border firms are related to stock prices.[7] Using both price and return-valuation models, Harris and Muller (1999) find that the U.S. GAAP earnings of cross-border firms are related to their market value. Lang, Lins, and Miller (2003) find that cross-border firms have better analyst coverage, which is associated with higher market valuations. Amir et al. (1993) and Barth and Clinch (1996) provide similar evidence, finding that the earnings reported by cross-border firms on Form 20-F are related to their stock market performance. Using both share prices and the proportion of small positive earnings, Lang et al. (2006) find that the reconciled accounting data of Form 20-F, Item 17 are less informative and more susceptible to managing earnings toward a target than that of the control firms. Also, Lang, Ready, and Yetman (2003) find that cross-listing firms have less aggressive earnings management than non-cross-listing firms in their local home markets. Together, these studies suggest that accounting measures of performance affect the stock prices of cross-border firms, with transparency limiting the opportunity to manage earnings.

Smith and Sofianos (1997) find that the stock prices of cross-border firms rise by 8 percent at the time of listing on U.S. stock exchanges and deteriorate thereafter. Lee (1991), Damodaran et al. (1993), Lau et al. (1994), and Rothman (1995) report a positive market reaction at the time of cross-border listing. However, Alexander et al. (1988) find a decline in stock prices of up to 26 percent for Canadian cross-border firms after three years of listing on U.S. exchanges. Similar results are reported in Howe and Kelm (1987) and

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[5] Saudagaran (1988) reports that cross-border firms' market capitalization is the main factor influencing decisions to list abroad. This result is consistent with the larger proportion of small firms cross-border listing on the Nasdaq, which requires a lower market value of public shares than the NYSE.

[6] See the NYSE Listing Standards and Procedures for Non-U.S. Corporations (1998) and Nasdaq Backgrounder, September 1998.

[7] Amir et al. (1993) and Frost and Kinney (1996) find that about one-third of their sample of non-U.S. cross-border-listed firms used U.S. GAAP to prepare the financial statements filed with the Securities and Exchange Commission (SEC) or reported no material differences between home GAAP and U.S. GAAP financial statements. The rest of the sample filed Form 20-F item 17, which reconciles home country GAAP operating performance to U.S. GAAP measures.

Foerster and Karolyi (1993, 1996). This stock price behavior resembles the pattern documented for domestic IPO firms.

Loughran and Ritter (1995) find that the operating performance of domestic firms issuing an IPO improves substantially at the time of the offering, but deteriorates five years after the issue.[8] Eckbo et al. (2000) re-examine these results, finding that long-run underperformance is associated with differences in risk factors between issuers and control non-issuers. Teoh et al. (1998) find that a sample of IPO firms is more likely than a matched non-IPO sample to have income-increasing depreciation policies and bad debt allowances in the IPO year. They conclude that firms with unusually high accruals in the IPO year manage earnings more than other firms. As a group, these studies suggest that the peak in earnings at the time of an IPO is likely related to managers' incentives to improve stock prices and reduce the cost of capital. Because the decision to go public is somewhat analogous to cross-border listing, these incentives should exist for firms that cross-border list. Therefore, results from prior studies suggest that managers of cross-border firms have incentives to manage earnings upward or cross-list in periods of high performance.

III. SAMPLE AND DATA

Sample Selection

The initial sample consists of 858 non-U.S. firms that cross-border listed on the NYSE and Nasdaq from 1985 to 2003.[9] The sample was obtained from the NYSE International Listing Department and Nasdaq.[10] To be included in the sample, data on a sample firm must be available on the Compustat Industrial Annual tape for the fiscal year of the cross-border listing. Only 550 firms survive this restriction. To minimize computational costs, firms that changed their fiscal calendars during the analysis period are excluded. This restriction eliminates 15 firms. The final sample consists of 535 cross-border firms. The NYSE and Nasdaq identify cross-border firms that raise new equity capital at cross-listing as IPO firms; firms that cross-list only existing home-country public shares are non-IPO firms. Based on the information obtained from the two stock exchanges, the final sample consists of 192 IPO and 343 non-IPO firms. The differences between these groups are summarized in Exhibit 1. The GAAP differences include mandated compliance with U.S. GAAP and Regulation S-X in Form 20-F, Item 18 for IPO firms. In contrast, non-IPO firms are allowed to cross-list with foreign GAAP and to reconcile material variations between the GAAP used to prepare their financial statements and U.S. GAAP and Regulation S-X in Form 20-F, Item 17.[11] The two subsamples are compared to examine whether cross-listing or raising equity capital most affects incentives to manage earnings.

IPO and non-IPO firms have incentives to maximize cash infusions and stock prices by managing earnings. These earnings management incentives are also created by the imposition of a minimum market value threshold for cross-listing on a U.S. stock exchange. Usually, the listing threshold must be met by the time of approval to cross-border list. Because 75 percent of IPO and non-IPO firms cross-border list in quarters one (18 percent), two (30 percent), and three (27 percent) of the cross-border year (year 0), I posit that earnings are likely managed in years -1 and 0. The 25 percent that cross-list in quarter four of year 0 are presumed to have managed earnings either in year 0 or -1 and 0. Based on the distribution of cross-listing quarters, I consider years -1 and 0 cross-listing years.

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[8] Aharony et al. (2000) provide similar results for IPO firms in the transitional economy of China. However, Healy and Palepu (1990) find no evidence of earnings declines after seasoned equity offerings.

[9] Firms that cross-border listed in the 1970s do not survive the Compustat data file used in the study.

[10] I thank Mark A. Baer, NYSE International Client Services, for providing the initial sample and data. An additional sample was obtained from each exchange website.

[11] The filing status of sample firms available on the SEC Electronic Data Gathering and Retrieval System (EDGAR) is consistent with IPO firms filing Item 18 and non-IPO Item 17. For more information on Form 20-F, see http: //www.sec.gov/about/forms/form20-f.pdf.

The earnings management and timing hypotheses are two potential explanations of any observed increase in performance and accruals at cross-listing years. To control for the timing hypothesis, each cross-border firm is matched with a Compustat-listed non-issuer chosen based on industry, year, U.S. stock exchange listing, and performance. The algorithm for performing this match, suggested by Barber and Lyon (1996) and Kothari et al. (2005), is as follows: Potential matching firms have not issued equity in test years -2 to 2 and are listed on the same U.S. stock exchange as the sample firm to alleviate biases due to differences between the NYSE and Nasdaq listing thresholds.[12] Given this constraint, a firm with the same two-digit industry code and the most similar performance (year -2 ROA) to the cross-border firm is selected as the matched firm. Performance matching is based on ROA in year -2 because firms are likely to cross-list when performance is high and they are also likely to engage in earnings management. I have avoided performance matching in cross-listing years when earnings management and performance are likely correlated. Kothari et al. (2005) suggest that such correlation weakens the reliability of inferences from discretionary accruals.

Panel A of Table 1 reports by year the number of cross-border firms that survived the sampling restrictions. The number of cross-border listings is in the single digits for most of the late 1980s and rises to double-digits from 1992 to 2003. The numbers of IPO firms are in double-digits in the bullish market of 1993 to 2000. Similarly, the numbers of non-IPO firms are in double digits from 1993 to 2002. Panel B provides industry representation of the sample. The sample is spread across a range of industries, with a minor concentration in manufacturing and transportation. The matching criteria implemented alleviate concerns about industry effects obscuring earnings management at cross-listing. Sample representation by country is not reported. However, the sample firms are spread across 48 countries, with the greatest representation in Canada, the United Kingdom, and Israel. To mitigate potential country effects, analyses on a sample excluding Canada, the United Kingdom, and Israel were performed to ensure that results are not country-driven. Those results are generally similar to the reported results.[13]

Estimation of Discretionary Accruals

Discretionary accruals are measured as the difference between total actual accruals and predicted nondiscretionary accruals.[14] The modified cross-sectional Jones (1991) model developed in Dechow et al. (1995) and refined in Kothari et al. (2005) is used to predict nondiscretionary accruals as follows:[15]

$$ACCR_{jt}/TA_{jt-1} = b_0 + b_1[(CREV_{jt} - CREC_{jt}/TA_{jt-1} + b_2[PPE_{jt}/TA_{jt-1}] + e_{jt} \qquad (1)$$

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[12] Matched firms are not conducting IPO or SEO during the test periods based on the review of Wall Street Journal Index, Lexis online services, and SDC new issues database for years -2 to 2.

[13] The combined results for Canada, the U.K., and Israel are consistent with the results reported.

[14] Total accruals are the difference between net income before extraordinary items and cash flow from operations.

[15] Shivakumar (2000) points out that the modified Jones model controls for changes in a firm's economic environment. Kothari et al. (2005) find that including a constant term controls for heteroscedasticity not alleviated by using assets as the deflator and mitigates problem of an omitted size variable, both of which make power of test comparisons more robust. Thus, model estimations include a constant term.

TABLE 1
Cross-Border Sample, Listing Year, and Industry Distribution

Panel A: Number of Listings by Calendar Year

Year	Number of Listings	Percent of Listings	Number of IPO Listings	Percent of IPO Listings
1985	3	0.56	0	0.00
1986	5	0.93	2	1.04
1987	12	2.24	2	1.04
1988	6	1.12	2	1.04
1989	12	2.24	5	2.60
1990	2	0.37	1	0.52
1991	7	1.31	4	2.08
1992	16	2.99	8	4.17
1993	30	5.61	16	8.33
1994	34	6.36	15	7.81
1995	28	5.23	12	6.25
1996	57	10.65	22	11.46
1997	58	10.84	27	14.06
1998	49	9.16	10	5.21
1999	48	8.97	21	10.94
2000	81	15.14	28	14.58
2001	41	7.66	7	3.65
2002	33	6.17	6	3.13
2003	13	2.43	4	2.08
Total	535	100.00	192	100.00

Panel B: Number of Listings by Industrial Classification

Industry	SIC Code[a]	Number of Listings	Number of IPO Listings
Agriculture, Forestry, and Fishing	0	5	0
Mining, Construction	1	46	8
Manufacturing	2	108	33
Manufacturing	3	136	59
Transportation and Public Utilities	4	128	55
Trade	5	22	7
Services	7	81	28
Services	8	6	1
Services	9	3	1

IPO denotes firms that issue initial public offering at the time of cross-border listing.

[a] First digit of SIC code.

where:

$ACCR_{jt}$ = total accruals for firm j in year t;
TA_{jt-1} = total assets for firm j in year $t-1$;
$CREV_{jt}$ = change in sales for firm j in year t;
$CREC_{jt}$ = change in accounts receivable for firm j in year t;

PPE_{jt} = property, plant, and equipment for firm j in year t; and
e_{jt} = error term.

Subtracting the change in accounts receivable in Equation (1) assumes that credit sales are discretionary (Dechow et al. 1995; Dechow et al. 2003). *CREC* is only subtracted in cross-listing years. The above model is separately estimated for each two-digit SIC group-year with at least ten firms. The estimated parameters in Equation (1) are used to compute discretionary accruals.

IV. RESULTS

Cross-Border Firms

Table 2 presents the mean and median returns on assets (*ROA*), cash flows, total accruals, current assets accruals (*CAAC*), and current liability accruals (*CLAC*) before (year −2), during (years −1 to 0), and after (years 1 to 2) cross-listing periods for cross-border firms.[16] I find that performance and all accrual variables peak in cross-listing years and fall significantly in subsequent years. For example, the median *ROA*, cash flows, and total accruals increase from 0.0799, 0.1027 and −0.0558 in year −2 to 0.0929, 0.1219 and −0.0375, respectively, in the cross-listing year and then decline to 0.0671, 0.1042 and −0.0591, respectively, in year 2. A similar pattern is observed for working capital accruals, which also peak in cross-listing years. This pattern of peak and trough across test variables supports both earnings management and timing listings to a window of opportunity.

In addition, Table 2 presents p-values from the t-test (mean) and Mann-Whitney test (median) comparing each test variable between the cross-listing and future periods. I find that the cross-listing period has significantly higher mean and median *ROA* (p-value = 0.00), cash flows (p-value = 0.00), and working capital accruals (p-value = 0.01) than the later years. Because accruals and cash flows are both higher in the cross-listing period, cross-border firms are perhaps managing earnings and/or timing listings to a window of opportunities.

Because managers are more likely to manage earnings with discretionary accruals, I summarize the descriptive statistics on discretionary accruals in Table 3, Panel A and results of regression specifications of discretionary accruals based on modified Jones models in Panel B. In Panel A, the mean and median discretionary accruals increase respectively from year −2 (−0.0074, −0.0074) to year 0 (0.0434, 0.0446) by approximately 700 percent and then fall in year 2 (−0.0127, −0.0012) by 129 percent and 103 percent. The mean and median cross-listing years (−1 and 0) discretionary accruals are 0.0506 and 0.0329, while future values are respectively −0.0111 and 0.0031 (years 1 and 2). I find that the cross-listing periods have significantly higher discretionary accruals than the later years (p-value = 0.00). This discretionary accruals result supports earnings management.

Panel B of Table 3 provides results of several specifications of discretionary accruals. Panel B reports the estimations of a modified Jones model with a dummy variable (*Manip*) coded 1 for cross-listing years (−1 to 0), and 0 otherwise. The dummy compares discretionary accruals in the two periods, with positive coefficients reflecting earnings management in the cross-listing period. Also, I adjust changes in net sales in the Jones model by

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[16] All variables are winsorized at the 1st and 99th percentiles. Total accruals and discretionary accruals are defined in Equation (1). Other test variables are defined as follow: cash flows are operating cash flows as reported on the statement of cash flows scaled by average total assets; *ROA* is the return on assets defined as the sum of net income and interest expense scaled by total assets in each year; Current assets accruals (*CAAC*) are the sum of accounts receivable, inventory and other current assets scaled by lagged total assets; Current liabilities accruals (*CLAC*) are the sum of accounts payable, taxes payable and other current liabilities scaled by lagged total assets.

TABLE 2
Earnings and Accruals Variables for Cross-Border Firms

Test Years	*ROA* Mean	*ROA* Median	*Cash Flows* Mean	*Cash Flows* Median	*ACCR* Mean	*ACCR* Median	*CAAC* Mean	*CAAC* Median	*CLAC* Mean	*CLAC* Median
−2	0.0833	0.0799	0.1219	0.1027	−0.0556	−0.0558	0.3378	0.3152	0.2230	0.2058
−1	0.1037	0.0959	0.1349	0.1231	−0.0548	−0.0510	0.4222	0.3611	0.3095	0.2504
0	0.1019	0.0929	0.1249	0.1219	−0.0101	−0.0375	0.5211	0.4082	0.3499	0.2627
1	0.0806	0.0819	0.1055	0.1038	−0.0419	−0.0436	0.3310	0.2977	0.2192	0.1932
2	0.0557	0.0671	0.1060	0.1042	−0.0653	−0.0591	0.3133	0.2855	0.2151	0.1922
−1 to 0 (M)	0.1023	0.0947	0.1352	0.1307	−0.0461	−0.0519	0.4659	0.3734	0.3342	0.2550
1 to 2 (P)	0.0674	0.0732	0.1049	0.1022	−0.0539	−0.0525	0.3236	0.2976	0.2196	0.1980
Differences (M-P)	0.0349	0.0215	0.0303	0.0285	0.0078	0.0006	0.1423	0.0758	0.1146	0.0570
p-values	0.00***	0.00***	0.00***	0.00***	0.09*	0.13	0.00***	0.00***	0.00***	0.00***

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*, **, *** Significant at the 0.10, 0.05, and 0.01 levels, respectively.

The test statistics for differences between cross-listing (−1 to 0) and post-listing (1 to 2) periods are t-test (mean) and Mann-Whitney test (median), with p-values reported. Total Accruals (*ACCR*) are the difference between net income before extraordinary items (Compustat item 18) and operating cash flow (Compustat item 308) scaled by lagged total assets (Compustat item 6). Current assets accruals (*CAAC*) are the sum of accounts receivable (Compustat item 2), inventory (Compustat item 3) and other current assets (Compustat item 68) scaled by beginning of the year total assets. Current liabilities accruals (*CLAC*) are the sum of accounts payable (Compustat item 70), taxes payable (Compustat item 71) and other current liabilities (Compustat item 72) scaled by beginning-of-year total assets. *Cash Flows* are operating cash flows as reported on the Statement of Cash Flows (Compustat item 308) scaled by average total assets. *ROA* is the return on assets defined as the sum of net income (Compustat item 172) and interest expense (Compustat item 15) scaled by total assets in each year. The cross-listing period includes one year before and the year of cross-border listing, in which earnings management is anticipated because 75 percent of the sample cross-border listed in quarter 1 (18 percent), 2 (30 percent), and 3 (27 percent) of year 0 (cross-border listing year). The post-listing periods include years 1 and 2 after cross-border listing. The numbers of firms-observations in each year −2 to 2 are 277, 471, 494, 520, and 494, respectively.

TABLE 3

Descriptive Statistics on Discretionary Accruals and Coefficients (t-statistics) from Modified Jones Models with Dummy (*Manip*) to Capture Cross-Border Years Earnings Management

Panel A: Discretionary Accruals (*DACC*)

Test Years	Mean	Median	p-values	n
−2	−0.0074	−0.0074	0.18	277
−1	0.0628	0.0127	0.21	471
0	0.0434	0.0446	0.00	494
1	−0.0097	−0.0021	0.58	520
2	−0.0127	−0.0012	0.74	494
−1 to 0 (M)	0.0506	0.0329	0.00	965
1 to 2 (P)	−0.0111	0.0031	0.41	1014
Differences (M-P)	0.0617	0.0298	0.00	***

Panel B: Coefficients (t-statistics) from Modified Jones Models

$$ACCR_{j,t} = b_0 + b_1 Manip + b_2(CREV - CREC)_{j,t} + b_3 PPE_{j,t} + e_{j,t}$$

Model based on:	*Manip*	Independent Variables *CREV − CREC*	 *PPE*	Adj. R^2	n
All Sample Pooled (t-value)	0.0324*** (4.17)	0.0620*** (6.65)	−0.0681*** (−10.40)	0.08	2595
Industry Basis (t-value)	0.0241*** (2.79)	0.0182*** (6.43)	−0.0569*** (−3.21)	0.09	155

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*, **, *** Significant at the 0.10, 0.05, and 0.01 levels, respectively.

In Panel A, Discretionary accruals (*DACC*) are calculated as the difference between Total Accruals and Nondiscretionary accruals (*NDA*), where *NDA* are estimated using modified Jones (1991) Model as follows:

$$ACCR = b_0 + b_1(CREV - CREC) + b_2 PPE + e$$

where:

CREV = change in net sale (Compustat item 12) for the year scaled by average total assets;
CREC = change in receivables (Compustat item 2) for the year scaled by average total assets; this variable is only subtracted in the cross-listing years; and
PPE = gross amount of property, plant, and equipment (Compustat item 7) scaled by total assets.

The test statistics for differences between cross-listing (−1 to 0) and post-listing (1 to 2) periods are t-test (mean) and Mann-Whitney test (median), with p-values reported.

In Panel B, parameter estimates for all sample model above are based on pooled regression over −2 to 2 years, while industry specification is based on average parameter estimates from the respective two-digit SIC-year regressions (with at least 10 firms in each two-digit SIC industry). For industry model, I provide mean coefficient estimates for the model above based on 155 two-digit SIC-year regressions. t-statistics are reported in parentheses below parameter estimates.

The variables in the Jones model above are defined as follows:

Manip = dummy variable coded 1 for cross-listing periods (years −1 to 0), and 0 otherwise (pre- and post-listing years); earnings management is anticipated in years −1 and 0 because 75 percent of cross-border listing took place in quarters 1 (18 percent), 2 (30 percent) and 3 (27 percent) of cross-listing year; positive and significant coefficients on *Manip* indicate that the positive discretionary accruals of cross-listing years are significantly higher than post values;

(*continued on next page*)

TABLE 3 (continued)

ACCR = total accruals for each year scaled by lagged total assets (Compustat item 6);
CREV = change in sales each year scaled by lagged total assets;
CREC = change in accounts receivable each year scaled by lagged total assets; because credit sales are presumed to be discretionary, increases in account receivable at cross-listing period are backed out;
PPE = gross amount of property, plant, and equipment each year scaled by lagged total assets; and
n = numbers of firms-year observations for pooled model, while n for industry specification represents two-digit SIC year-observations.

Adjusted R^2 is reported in column 5.

backing out increases in accounts receivable only at cross-listing years to reflect the assumption that all changes in credit sales are discretionary. All variables are winsorized at the 1 percent tails of their respective distributions. The estimation of pooled-sample specification is reported in the first row, while the mean coefficient estimates for two-digit industry specification are reported in the second row. The coefficients for independent variables are reported in columns two, three, and four, respectively, with adjusted R^2 in the fifth column.

Consistent with prior studies, I find a positive and significant coefficient on *CREV* − *CREC* (sales change minus change in receivables) and a negative and significant coefficient on *PPE* (property, plant, and equipment) for both pooled (0.0620, $t = 6.65$; −0.0681, $t = -10.40$) and industry (0.0182, $t = 6.43$; −0.0569, $t = -3.21$) models, respectively. Consistent with earnings management, the coefficients on the dummy (*Manip*) are positive and significant, with coefficients of 0.0324 ($t = 4.17$) on pooled specification and 0.0241 ($t = 2.79$) on industry model. The positive coefficients suggest that cross-listing periods have significantly higher discretionary accruals than the later years. These results are qualitatively similar to the Panel A of Table 3 descriptive discretionary accruals results. Therefore, taken together, the findings provide further evidence that discretionary accruals are higher at the time of cross-listing than in later years.

Using a matched-firm research design to control for performance, industry, and U.S. stock exchange listings, I examine whether the high cross-listing years discretionary accruals are due to earnings management. Table 4 presents a direct test of the differences between 209 cross-border firms and their control firms, matched based on two-digit SIC, cross-listing year, year −2 *ROA*, and U.S. stock exchange listing. Performance matching reduces the sample to 277 firms that have year −2 *ROA* data, while other matching constraints reduce the number of sample firms to 209. Matching based on year −2 *ROA* rather than performance at cross-listing periods is likely to enhance the reliability of inferences because earnings management appears to correlate with performance in the cross-listing period. Also, Table 4 provides p-values from Mann-Whitney tests comparing differences in *ROA*, cash flows, total accruals, working capital accruals, and discretionary accruals between cross-border and matched firms.

I find that cross-border firms have significantly higher *ROA* (p-value = 0.00), cash flows (p-value = 0.02), current liability accruals (p-value = 0.00), and discretionary accruals (p-value = 0.00) than matched firms at the time of cross-listing (−1 to 0).[17] Similar results are reported in cross-listing year 0, except that differences in cash flows between sample and matched firms are insignificant. However, differences in discretionary accruals

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[17] Because sample firms have higher cash flows than matched firms, the results are consistent with timing listing to a window of opportunities.

TABLE 4
Earnings and Accruals Differences (Diff) between Cross-Border (209) and Control Firms (209) Matched Based on Year −2 *ROA*, Industry, and Stock Exchange

p-value for Difference (Diff) between Cross-border (C) and Matched (M) Firms

	ROA			***Cash Flows***			***ACCR***			
Test Years	**C**	**M**	**Diff p-value**	**C**	**M**	**Diff p-value**	**C**	**M**	**Diff p-value**	**n**
−2	0.0808	0.0789	0.74	0.1062	0.1146	0.46	−0.0524	−0.0551	0.67	418
−1	0.0847	0.0736	0.01***	0.1148	0.0993	0.06*	−0.0464	−0.0459	0.92	418
0	0.0768	0.0654	0.03**	0.1068	0.0975	0.16	−0.0547	−0.0572	0.79	418
1	0.0745	0.0636	0.02**	0.1010	0.1014	0.82	−0.0458	−0.0586	0.13	418
2	0.0604	0.0644	0.86	0.0976	0.1053	0.39	−0.0611	−0.0684	0.43	418
−1 to 0	0.0813	0.0703	0.00***	0.1117	0.0984	0.02**	−0.0532	−0.0512	0.78	418
	CAAC			***CLAC***			***DACC***			
Test Years	**C**	**M**	**Diff p-value**	**C**	**M**	**Diff p-value**	**C**	**M**	**Diff p-value**	
−2	0.3001	0.3358	0.38	0.1976	0.1831	0.60	−0.0124	−0.0227	0.16	418
−1	0.3122	0.3110	0.91	0.2178	0.1891	0.00***	0.0134	0.0001	0.50	418
0	0.3141	0.3043	0.46	0.2189	0.1672	0.00***	0.0414	−0.0034	0.00***	418
1	0.2692	0.2851	0.17	0.1863	0.1682	0.34	0.0095	−0.0335	0.00***	418
2	0.2466	0.2815	0.35	0.1836	0.1687	0.10*	0.0164	−0.0510	0.00***	418
−1 to 0	0.3129	0.3093	0.55	0.2184	0.1788	0.00***	0.0274	−0.0014	0.00***	418

(continued on next page)

TABLE 4 (continued)

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*, **, *** Significant at the 0.10, 0.05, and 0.01 levels, respectively.

The test statistics are based on the differences (Diff) in median between sample and matched control firms (Mann-Whitney) with p-values reported. Unreported t-tests based on the differences in means are consistent.

Matched control firms have the same two-digit SIC, U.S. stock exchange listing, year, and the closest *ROA* in year −2 with the sample. Because earnings management and performance are likely correlated in cross-listing years (−1 to 0), matching is based on year −2 *ROA*. The matching restrictions reduce sample firms from 277 firms with *ROA* data in year −2 to 209 firms.

Total Accruals (*ACCR*) are the difference between net income before extraordinary items (Compustat item 18) and operating cash flow (Compustat item 308) scaled by lagged total assets (Compustat item 6). Discretionary accruals (*DACC*) are calculated as the difference between total accruals and nondiscretionary accruals (*NDA*), where *NDA* are estimated using modified Jones (1991) Model as follows:

$$ACCR = b_0 + b_1(CREV - CREC) + b_2 PPE + e$$

where:

$ACCR$ = total accruals scaled by lagged total assets;
$CREV$ = change in net sale (Compustat item 12) for the year scaled by lagged total assets;
$CREC$ = change in receivables (Compustat item 2) for the year scaled by lagged total assets; *CREC* is only subtracted from *CREV* in cross-listing years; and
PPE = gross amount of property, plant, and equipment (Compustat item 7) scaled by lagged total assets.

Current assets accruals (*CAAC*) are the sum of accounts receivable (Compustat item 2), inventory (Compustat item 3), and other current assets (Compustat item 68) scaled by beginning of the year total assets. Current liabilities accruals (*CLAC*) are the sum of accounts payable (Compustat item 70), taxes payable (Compustat item 71), and other current liabilities (Compustat item 72) scaled by beginning-of-year total assets. *Cash Flows* are operating cash flows as reported on the Statement of Cash Flows (Compustat item 308) scaled by average total assets. *ROA* is the return on assets defined as the sum of net income (Compustat item 172) and interest expense (Compustat item 15) scaled by total assets in each year. n is the number of sample and matched firms in each year.

between the two groups continue to be significant in years 1 (p-value = 0.00) and 2 (p-value = 0.00). Therefore, the findings appear to suggest that cross-border firms are managing earnings at the cross-listing period. The pre-listing year (−2) differences between sample and matched firms for *ROA*, cash flows, and all accruals variables are insignificant. This finding lends support to the matching algorithms implemented. Because cross-border and matched firms face similar business conditions, including performance, industry, year, and U.S. stock exchange regulatory hurdles, the significant differences in discretionary accruals between the sample and matched firms suggest that cross-listing firms manage earnings.

IPO and Non-IPO Subsamples

A closer look at the evidence of earnings management leaves open the question of whether the high discretionary accruals is due to cross-listing per se or incentives to maximize cash infusion for IPO firms raising new equity capital. These firms receive a cash infusion at cross-listing and are required to comply with the more-transparent U.S. GAAP in Form 20-F, Item 18. In contrast, non-IPO firms cross-list their existing home public shares and are allowed to report less transparently in Form 20-F, Item 17. Teoh et al. (1998), Lang et al. (2006), and Hunton et al. (2006) point out that greater reporting transparency mitigates earnings management.[18] The differences between the two groups of cross-listing firms and their implications for earnings management are summarized in Exhibit 1. Based on the comparative analysis, I argue that IPO firms have greater incentives than non-IPO firms to manage earnings, list in a window of opportunity, and maximize share prices and cash infusions by seeking higher levels of investor recognition at listing. Nevertheless, by comparing IPO and non-IPO cross-border firms, I provide insight into the impact of the differences identified in Exhibit 1 on firms' incentives to manage earnings in the cross-listing period.

Table 5 presents the results of comparing IPO and non-IPO firms. Panel A of Table 5 presents median values for IPO firms, while Panel B of Table 5 reports on non-IPO firms. In both panels, *ROA*, cash flows, working capital accruals, and discretionary accruals increase from the pre-listing year (−2) to peak in cross-listing years (−1 to 0) and then fall significantly in subsequent years (1 to 2). The consistency of results across IPO and non-IPO subsamples lends support to the theory that cross-listing alone, rather than their differences in Exhibit 1, provides the incentives to manage earnings. Because discretionary accruals offer managers more flexibility to manage earnings, I summarize their median values. The median discretionary accruals for IPO firms (non-IPO firms) peak at approximately 0.0602 (0.0375) at cross-listing years and decline to an insignificant level in year 2, −0.0002 (−0.0038) by 100 percent (110 percent), respectively. In spite of their differences reported in Exhibit 1, both IPO and non-IPO firms appear to have a similar pattern of discretionary accruals, with a peak in cross-listing years.

By comparing IPO and non-IPO firms, Panel C of Table 5 presents direct evidence that cross-listings per se affect incentives to manage earnings. I find that the differences between IPO and non-IPO firms in year 0 for current assets accruals (0.0664 p-value = 0.01) and current liability accruals (0.0339 p-value = 0.05) are significant, with IPO firms having higher values. In both cross-listing periods (years 0 and −1 to 0), IPO firms also have

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[18] Reese and Weisbach (2001) find that cross-border firms with more transparency report conservatively. Hunton et al. (2006) report that greater transparency in reporting formats and comprehensive income facilitate the detection of earnings management. Lang et al. (2006) provide circumstantial evidence indicating that the more stringent regulatory oversight of Form 20-F, Item 18 is associated with reduced earnings management.

TABLE 5
Differences in Earnings Management between IPO and Non-IPO Firms

Test Years	*ROA*	*Cash Flows*	*ACCR*	*CAAC*	*CLAC*	*DACC*	n
Panel A: Median Earnings and Accruals Variables for IPO Firms							
−2	0.0644	0.0579	−0.0146	0.3317	0.2422	0.0324	76
−1	0.0876	0.0717	−0.0596	0.3871	0.2862	0.0048	171
0	0.0838	0.0884	−0.0469	0.4697	0.3097	0.0602	174
1	0.0737	0.0819	−0.0440	0.2842	0.1818	0.0032	186
2	0.0601	0.0878	−0.0639	0.2651	0.1860	−0.0002	179
Panel B: Median Earnings and Accruals Variables forNon-IPO firms							
−2	0.0577	0.0978	−0.0645	0.3052	0.2074	−0.0094	201
−1	0.0649	0.0877	−0.0561	0.3424	0.2565	0.0122	300
0	0.0563	0.0792	−0.0591	0.3683	0.2596	0.0375	320
1	0.0527	0.0699	−0.0508	0.2651	0.1895	−0.0044	334
2	0.0406	0.0744	−0.0662	0.2654	0.1897	−0.0038	315
Panel C: Differences between IPO andNon-IPO Firms at Cross-Listing Periods							
−1	0.0223***	−0.0131	0.0010	0.0324	0.0334	−0.0127	471
(p−value)	(0.00)	(0.44)	(0.95)	(0.32)	(0.12)	(0.62)	
0	0.0253***	0.0101	0.0142	0.0664***	0.0339**	0.0231	494
(p−value)	(0.00)	(0.44)	(0.28)	(0.01)	(0.05)	(0.14)	
−1 and 0	0.0236***	0.0024	0.0101	0.0553***	0.0342***	0.0159	965
(p−value)	(0.00)	(0.82)	(0.34)	(0.00)	(0.01)	(0.23)	

(continued on next page)

TABLE 5 (continued)

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*, **, *** Significant at the 0.10, 0.05, and 0.01 levels, respectively.

In Panel C, the test statistics for differences between IPO and non-IPO cross-border firms is the Mann-Whitney test with p-values reported. Results based on t-tests are consistent. IPO firms receive a cash infusion at cross-listing, while non-IPO firms do not.

Total Accruals (*ACCR*) are the difference between net income before extraordinary items (Compustat item 18) and operating cash flow (Compustat item 308) scaled by lagged total assets (Compustat item 6). Discretionary accruals (*DACC*) are calculated as the difference between total accruals and nondiscretionary accruals (*NDA*), where *NDA* are estimated using modified Jones (1991) Model as follows:

$$ACCR = b_0 + b_1(CREV - CREC) + b_2 PPE + e$$

where:

$ACCR$ = total accruals scaled by lagged total assets;
$CREV$ = change in net sale (Compustat item 12) for the year scaled by lagged total assets;
$CREC$ = change in receivables (Compustat item 2) for the year scaled by lagged total assets; this variable is subtracted during cross-listing years; and
PPE = gross amount of property, plant, and equipment (Compustat item 7) scaled by lagged total assets.

Current assets accruals (*CAAC*) are the sum of accounts receivable (Compustat item 2), inventory (Compustat item 3), and other current assets (Compustat item 68) scaled by beginning of the year total assets. Current liabilities accruals (*CLAC*) are the sum of accounts payable (Compustat item 70), taxes payable (Compustat item 71), and other current liabilities (Compustat item 72) scaled by beginning-of-year total assets. *Cash flows* are operating cash flows as reported on the Statement of Cash Flows (Compustat item 308) scaled by average total assets. *ROA* is the returns on assets defined as the sum of net income (Compustat item 172) and interest expense (Compustat item 15) scaled by total assets in each year. The cross-listing period includes one year before and the year of cross-border listing, in which earnings management is anticipated because 75 percent of the sample cross-border listed in quarters 1 (18 percent), 2 (30 percent), and 3 (27 percent) of year 0 (cross-border listing year). The post-listing period include years 1 and 2 after cross-border listing year.

significantly higher median *ROA* (0.0253 p = 0.00, 0.0236 p = 0.00) than non-IPO firms. However, the differences in discretionary accruals, accruals, and cash flows between IPO and non-IPO firms are insignificant at the cross-listing period. Because of the importance of discretionary accruals in demonstrating earnings management, the finding suggests that it is cross-listing rather than the differences between IPO and non-IPO reported in Exhibit 1 that affects incentives to manage earnings.

The pattern of insignificant difference in cash flows, accruals, and discretionary accruals between IPO and non-IPO firms in Table 5 is also evident in the firm-specific returns in Table 6. This table provides cross-listing years as well as future years size-adjusted returns and sales growth for the cross-border sample, IPO, non-IPO, and the differences between subsamples. Consistent with the previous results, I find that cross-border firms have median size adjusted returns (0.1775) that appear to peak in cross-listing years (−1 to 0) and fall significantly in subsequent years (−0.0562). The cross-listing year returns are significantly higher than their future values (p-value = 0.00). The poor future stock performance supports earnings management. Because of insufficient returns data for IPO firms in years −2 and −1, no comparison between IPO and non-IPO firms is conducted in the periods. However, the differences in all test periods for which data are available between IPO and non-IPO firms are insignificant.

The results for sales growth are somewhat similar to returns results and are reported in Table 6. The median sales growth in cross-listing years 0 (0.3039) and −1 and 0 (0.2856) is higher than the future years 1 and 2 (0.1652). These differences between the two periods are significant (p-value = 0.00). I find that IPO firms have significantly higher sales growth than non-IPO firms in cross-listing years 0 (p-value = 0.06) and −1 and 0 (p-value = 0.04). The differences in sales growth provide a partial explanation as to why IPO firms are associated with higher working capital accruals in Table 5 than non-IPO firms. This finding by itself is not surprising since Dechow et al. (1998) indicate that a firm invests in working capital accruals to increase forecasted sales growth and earnings. However, the sales results do not appear to induce a difference in discretionary accruals between IPO and non-IPO firms, as reported in Table 5.

V. CONCLUSIONS

This study examines whether a sample of foreign firms which cross-border listed on U.S. stock exchanges during 1985–2003 manages earnings at cross-listing years or times listing to a window of opportunity. Because 48 percent and 75 percent of the sample firms, respectively, cross-list before quarters three and four of their cross-border year, I presume that years −1 and 0 are potentially earnings-manipulation years and refer to them as cross-listing years. I find that ROA, cash flows, and discretionary accruals peak in cross-listing periods and fall significantly in subsequent years. The cross-listing period discretionary accruals and cash flows are significantly higher than in later years. These results support either earnings management or timing listing to a window of opportunity.

To provide further evidence, I use a matched-firm research design to control for performance, industry, and U.S. stock exchange listings. I find that cross-border firms have significantly higher discretionary accruals at the cross-listing period than matched firms. Because cross-border and matched firms have similar business conditions including performance, the findings are suggestive of earnings management.

Finally, to examine whether the high discretionary accruals are associated with the differences between IPO and non-IPO firms identified in Exhibit 1, I compare IPO and non-IPO firms. I find that IPO and non-IPO firms have similar levels of cash flow, accruals, and discretionary accruals at cross-listing periods. The findings suggest that differences

TABLE 6
Future and Cross-Border Years Stock Returns and Sales Growth for Sample Firms, IPO Compared to Non-IPO firms

	Size-Adjusted Returns						Sales Growth				
	Sample		Differences between IPO and Non-IPO				Sample	Differences between IPO and Non-IPO			
Test Years	Mean	Median	IPO	Non-IPO	Diff	p-value	Median	IPO	Non-IPO	Diff	p-value
−2	0.1407	0.1228 (26)					0.2010 (121)	0.0632	0.1690	−0.1561	0.00
−1	0.1799	0.1718 (47)					0.2543 (283)	0.1108	0.1415	0.0276	0.49
0	0.0220	0.0027 (121)	0.0354	−0.0302	0.0655	0.92	0.3039 (483)	0.2797	0.2175	0.0624	0.06
1	−0.0323	−0.0173 (140)	0.1274	−0.0627	0.1899	0.11	0.1875 (520)	0.1108	0.1415	−0.0058	0.83
2	−0.0356	−0.0542 (121)	−0.0871	−0.0539	−0.0332	0.15	0.1461 (498)	0.1203	0.1231	−0.0148	0.58
−1 to 0	0.1853	0.1775 (168)					0.2856 (766)	0.2465	0.1981	0.0518	0.04
1 to 2	−0.0509	−0.0562 (261)	−0.0764	−0.0599	−0.0164	0.69	0.1654 (1018)	0.1142	0.1372	−0.0105	0.58

The test statistics that median is different (Diff) between IPO and non-IPO firms are obtained from Mann-Whitney tests with median p-values reported. Numbers of firms-observation are in parentheses below the sample median values.

Size-adjusted returns are computed following Bradshaw et al. (2006). Specifically, stock returns, inclusive of dividends and other distributions, are obtained from CRSP tape. The size-adjusted returns are calculated from the start of the fourth month subsequent to the fiscal year-end. To adjust cross-listing firms' returns by size, each firm's return is deducted from the average domestic firm return in the same size matched decile, where size is measured as the market value at the beginning of the return cumulation period. Because of insufficient returns data on IPO firms, results for IPO and non-IPO for year −2, −1, and −1 to 0 are not reported. Sales growth is current period sales minus prior year scaled by prior year. For each variable, total sample median along with differences in median between IPO and non-IPO cross-border firms with p-values are reported. The results are provided for cross-listing period (−1 to 0), in which earnings management is anticipated and the post-listing period including years 1 and 2 after cross-border listing year (future).

between the two groups do not appear to influence earnings management at cross-listing. Therefore, cross-listing per se rather than incentives to maximize the cash infusion received from new equity capital appears to induce high discretionary accruals at cross-listing periods.

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Profits versus Losses: Does Reporting an Accounting Loss Act as a Heuristic Trigger to Exercise the Abandonment Option and Divest Employees?

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ABSTRACT: The binary classification of firms into profits or losses represents a powerful heuristic. The literature that has examined the impact on the firm of this earnings heuristic has focused on the earnings management actions of small profit firms. The impact of this earnings heuristic on the actions of firms reporting accounting losses and the decision-making effects the heuristic may have other than earnings management have not been examined. In this study we hypothesize that reporting an accounting loss acts as a heuristic trigger for firms to exercise the abandonment option and discard unproductive investments. The results are consistent with the hypothesis. We find that there is a sharp and economically significant discontinuity around zero in the level of investment in labor between small profit and small loss firms. The discontinuity is due to loss firms having a lower-than-expected level of investment in labor, given their economic fundamentals. Further tests show that this discontinuity is due to the exercise of the abandonment option. We find that firms switching from a profit to a loss cut labor to a greater extent than other firms with similar changes in earnings that do not pass the loss threshold. Taken together the results are consistent with the accounting loss heuristic acting as a major disciplinary or incentive altering event that resolves agency problems.

Keywords: *abandonment option; employees; financial reporting incentives; losses; thresholds.*

Data Availability: *Data are commercially available from sources identified in the text.*

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I. INTRODUCTION

One of the oldest and most visible accounting classifications is that of firms as either reporting an accounting profit or reporting an accounting loss. The profit versus loss binary classification of firms represents a significant, simple, and powerful earnings heuristic. The literature that has examined the impact of this earnings heuristic on the actions of firms has focused on how it creates incentives for earnings management activities by small profit firms (Roychowdhury 2006; Dechow et al. 2003). The impact of this earnings heuristic on the actions of firms reporting accounting losses and the incentive and decision-making effects the heuristic may have other than earnings management have not been examined.

The objective of this paper is to examine whether simply reporting an accounting loss acts as a heuristic (hereafter, the loss heuristic) to divest unproductive investments due to the resolution of agency problems. We argue that the loss heuristic acts as a major disciplinary event that resolves agency problems and results in the manager's incentives being realigned with shareholders. We hypothesize that one of the first implications of this change in incentives is that reporting an accounting loss acts as a trigger to exercise the abandonment option and divest factors of production, divisions, and/or projects that represent negative net present value investments. In contrast, firms reporting profits may be reluctant to divest negative net present value projects due to the cost to the manager's own reputation and the short-term restructuring costs associated with divestment, which could result in the firm missing earnings benchmarks.

Our argument that the loss heuristic acts as a trigger to exercise the abandonment option gives rise to our main empirical prediction that there is a regime shift at the zero earnings threshold in the level of investment between firms reporting profits and firms reporting losses, not explained by economic fundamentals. This is because firms reporting losses will have a lower-than-expected level of investment as the impact of reporting a loss acts as a catalyst to divest unproductive investments. The impact of reporting a loss on the exercise of the abandonment option could be reflected in the divestment of a number of different factors of production as well as whole divisions of a firm's operations.

We choose to examine the impact of reporting a loss on investment in employees, specifically the investment in fixed labor. We use employees as our investment proxy for a number of reasons. First, investment in employees is a significant cost. The law of diminishing returns implies this will be one of the first factors of production to be subject to inefficiencies. As a consequence, this is likely to be one of the first investments to be cut. Second, relative to capital expenditure, investments in employees are liquid and reversible (see Pindyck 1988). This allows us to observe a continuum of divestment. Third, divestment of whole divisions will be reflected in a reduction of employees. Finally, the use of employees is appealing because all firms have employees and, as a consequence, the impact of the loss heuristic can be tested across a broad cross-section of firms.

Using our model of employee demand, which controls for economic fundamentals, we provide large-sample systematic evidence that there is a switch in investment in employees between firms reporting profits and those reporting losses. We find there is a discontinuity at the zero earnings threshold in the level of investment between small profit firms and small loss firms. The discontinuity is attributable to small loss firms having lower than expected investment in employees.

We find evidence consistent with this discontinuity being due to the loss heuristic acting as a trigger to exercise the abandonment option. First, we find small loss firms report a significantly greater percentage of discontinued operations than small profit firms. The evidence is consistent with a regime shift at the zero earnings threshold in the decision to discontinue operations. Second, we find that when a firm first moves from reporting a profit to reporting a loss, the zero earnings threshold acts as a catalyst for a decline in investment in employees that is greater than the expected fundamental demand impact of such a change.

Further tests provide additional evidence on the impact of the loss heuristic on the incentive to divest employees. We find the impact is stronger for large firms, which we argue are likely to be more prone to over-investment problems. We also find the divestment of employees is greater for firms with a high earnings response coefficient and high share turnover. We argue that these firms are more likely to suffer a significant price drop when they report a loss, and that this threat exerts a direct and immediate disciplinary effect on management.

The primary contribution of this study is to show that the binary classification of firms into profit or losses is a powerful heuristic that can have real economic consequences other than creating incentives for earnings management. Our main result is that reporting a loss acts as a decision cue to divest employees and discontinue operations. We interpret this result as being consistent with the loss heuristic acting as a major disciplinary event that reduces agency conflicts and changes the incentives of firm management towards taking real actions to improve a firm's performance.

Our findings are also relevant to two steams of accounting literature. First, our result is relevant to Hayn's (1995) theory that investors in pricing earnings respond differently to losses and profits because loss firms could be exercising the abandonment option.[1] Our result that loss firms are actually discarding investments provides support for this theory. Second, our results are relevant to the literature that seeks to understand the reasons for the kink at the zero profit/loss threshold in the frequency distribution of firms (Burgstahler and Dichev 1997b; Hayn 1995). The papers that have attempted to explain this kink have focused on the earnings management actions of small profit firms (Roychowdhury 2006; Dechow et al. 2003) or methodological issues (Durtschi and Easton 2005). Our results provide some indirect support for an additional explanation proposed by Beaver et al. (2003). They contend that the discontinuity in the number of firms around zero is at least partly due to there being a lower number of small loss firms due to the greater variance in the earnings of loss firms. Our result that crossing the zero earnings threshold acts as a catalyst for divestment supports this argument. This is because the variability in the earnings of loss firms will be greater as once-off restructuring charges are incurred and as a result more firms are likely to lie in the extremes of the earnings distribution.

Our result also provides motivation for research to explore an explanation for the kink proposed, but not examined, by Dechow et al. (2003, 374). They propose that having a clearly defined objective to report a profit could result in management of loss firms taking real actions to improve performance and this could be an explanation for the preponderance of small profit firms. Our result, that the loss heuristic triggers the exercise of the abandonment option, supports their argument that management of loss firms will take real actions. However, we have not examined whether these real actions result in improved performance or whether they give rise to a cluster of firms above the zero earnings threshold. This is left to future research.

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[1] The abandonment option hypothesis suggests that shareholders of loss firms always have the option to redeploy or liquidate the unprofitable investments within the firm if they expect the loss to continue. Following Hayn (1995) the share price or the market valuation effects of the abandonment option has been subject to extensive research (Berger et al. 1996; Burgstahler and Dichev 1997a; Collins et al. 1999). We are not aware of any papers that examine whether reporting a loss acts as a trigger to actually exercise the abandonment option.

The final contribution of this study is that we introduce a simple model of investment in fixed labor that can be used to examine the investment decisions of firms in a range of different contexts. Prior research in the accounting literature has focused mainly on R&D (e.g., Bushee 1998; Dechow and Sloan 1991) and in the finance literature on capital expenditure.

The remainder of the paper is organized as follows: Section II develops several testable hypotheses; Section III describes the data; Section IV presents our empirical model and results. Section V concludes.

II. HYPOTHESES

The Impact of Reporting a Loss on Firms' Demand for Labor

It has long been recognized that the potential divergence in incentives between managers and shareholders can give rise to agency problems such as over-investment. Prior research has examined several forms of external disciplinary events, such as CEO changes and takeovers, that have forced a reduction in agency problems and resulted in the firm being restructured and downsized. For example, Weisbach (1995) finds that the likelihood of divesting "unsuccessful" acquisitions is positively correlated with CEO changes. Bhide (1989), Bhagat et al. (1990), and Berger and Ofek (1996) all provide evidence suggesting that hostile takeovers are commonly followed by divestment. We argue that the reporting of an accounting loss, due to its use as a decision cue, also acts as a major disciplinary event or trigger that resolves agency problems.

Jensen (1986) and Boot (1992) have argued that agency problems lead highly profitable firms to be unproductive, cost inefficient, and reluctant to divest loser projects. Such firms may be reluctant to divest negative net present value projects due to both the short-term restructuring costs associated with divestment, which could result in them missing earnings benchmarks, and the cost to the manager's own reputation.[2] When a firm reports a loss some of these agency problems could be resolved.

The zero earnings threshold represents a powerful and salient heuristic.[3] The significance of this earnings heuristic implies that when firms report an accounting loss, this could act as a trigger for a number of outside forces to intervene in the operations of the firm. The loss heuristic could be used by boards of directors, large blockholders, or regulatory agencies as a reference point to intervene, by the equity market to assign a lower share price and lenders to assign a higher cost of finance. Managers in a loss position, due to concerns about their own jobs and a higher cost of finance are likely to take immediate actions to improve performance.

One of the first actions a firm reporting a loss is likely to take is to exercise the abandonment option and divest both factors of production and divisions that represent negative net present value investments. This gives rise to our first hypothesis that there will be a difference in the investment decisions between firms reporting an accounting loss and firms reporting an accounting profit not explained by economic fundamentals. If loss firms are divesting or abandoning investments, then these differences, we predict, will be reflected in lower investment in labor. This leads to the first hypothesis:

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[2] Boot (1992) argues that if management values firm size or reputation, then one expects it to be reluctant to sell assets (downsize) for efficiency reasons alone. He further argues that management postpones asset sales because abandoning an unsuccessful strategy impacts on the market's assessment of a manager's ability. Specifically, a manager is reluctant to divest because a divestiture is essentially an admission that an inappropriate project choice was made initially and hence adversely affects perceptions of his ability. Boot (1992) finds that, on average, there is too little divestiture relative to the shareholders' optimum.

[3] See Degeorge et al. (1999, 5–8) for discussion and references as to at least three psychological effects as to why the salience of the zero-earnings threshold could act as a heuristic or decision rule for participants in the capital market. First, there is something fundamental about positive and nonpositive numbers in human thought process. Second, from prospect theory, individuals behave as if they evaluate outcomes as changes from a reference point. Third, thresholds come to the fore because people depend on rules of thumb to reduce transaction costs.

> **H1:** *Ceteris paribus,* firms that report an accounting loss have a lower level of incremental investment in employees than economically equivalent firms that report an accounting profit.

To operationalize this hypothesis as an empirical experiment we examine small loss firms. The arguments should also apply to large loss firms. However, it is more difficult to control for economic fundamentals of large loss firms.

In order to test directly whether the differential investment between profit firms and loss firms is due to the exercise of the abandonment option, we examine the employment decisions of firms that have recently crossed the threshold. If the loss heuristic acts as a major disciplinary event that resolves agency problems, then drastic changes in a firm's focus should quickly follow the event that reduced the agency conflict. As a direct test of this, we examine whether the firm's immediate reaction to the move from a profit to a loss is the divestment of a number of employees that is greater than the normal fundamental demand impact of such a change. This leads to the following hypothesis:

> **H2:** Firms that move from reporting an accounting profit to reporting an accounting loss have an abnormal negative change in investment in employees.

Cross-Sectional Variation in the Impact of Reporting a Loss on Firms' Demand for Labor

We predict that the effect of switching from reporting a profit to reporting a loss on investment in employees will vary across firms. In this section we develop hypotheses for the type of firms that are most likely to be affected.

Large Firms

The incentive to divest unprofitable projects on reporting a loss will be more evident for those firms that suffer from greater agency problems. As a proxy for this we use large firms. Jensen (1986) and Boot (1992) suggest that large firms are more prone to overinvestment problems. This leads to the following hypothesis:

> **H3:** Large firms are more likely to have an abnormal negative change in investment in employees when they move from reporting a profit to reporting a loss.

Sensitivity of Stock Prices to Earnings

Management is more likely to react to reporting a loss and divest employees when there is a strong association between current period earnings and current period stock price. This is because firms whose current stock price is more sensitive to current earnings are likely to have a greater negative share price reaction to reporting an accounting loss. A large negative price reaction is more likely to have a direct and immediate disciplinary effect on management and could also act as an external cue for other agents such as the board of directors to intervene in the management of the firm. This leads us to the hypothesis:

H4: The more sensitive a firm's stock price is to current period earnings, the more likely there is to be a greater negative change in investment when a firm moves from reporting a profit to reporting a loss.

III. DATA AND SAMPLE SELECTION

Sample Selection

We use a sample of 77,711 firm-year observations from Compustat firms over the period 1983 through to 2003. The final sample was determined by including all available Compustat firm years except for observations without the data for the variables described below.

Dependent Variable

We operationalize our proxy for investment decisions as the percentage change in number of employees between end of year $t-1$ and year t (Compustat # 29). We use the percentage change in employees because in firm-level data the firm-specific "fixed effect" is likely to dominate in explaining the level of employees. This has two implications. First, the use of levels lowers the power of the experiment to obtain information as to what drives inter-firm investment differences other than firm-specific effects. Second, the residuals in the levels regressions are serially correlated.

Sample Descriptive Statistics

Descriptive statistics, for the percentage change in employees and the control variables, for the full sample of observations that are used in this study, are summarized in Table 1. The average (median) percentage change in employees is 5.4 percent (1.6 percent). This is close to the growth rate in real GDP over the period of the study of 3.4 percent.

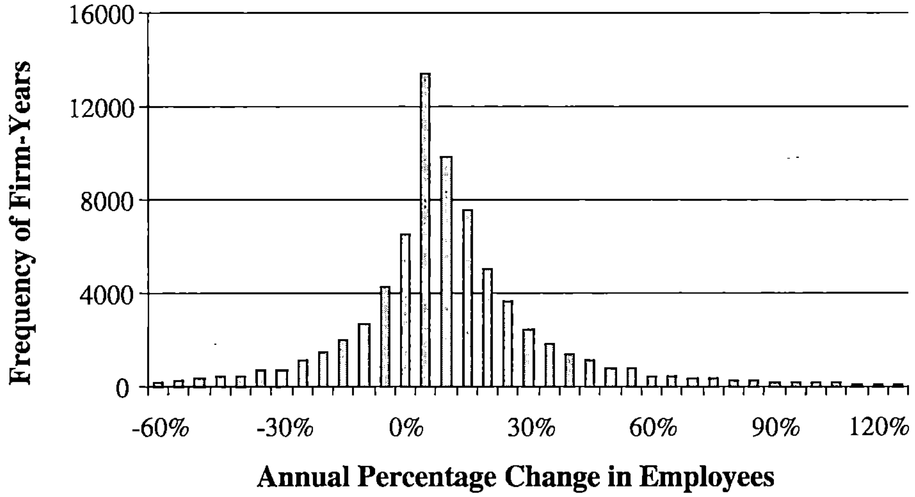
Figure 1 presents the distribution of employee changes that shows a single peaked bell-shaped distribution. The density of the observations in peak, supported by the kurtosis statistic of 7.18, suggests a heavily clustered large number of firms with very small yearly labor adjustment. To understand this visually, note that there is a sharp drop in the number of firms in intervals adjacent to the interval of central tendency. This is consistent with the evidence validated in many labor microeconomic studies that changes to employees are sticky or that firms adjust employees infrequently (e.g., Cooper and Willis 2004; Caballero

TABLE 1
Descriptive Statistics

	$\Delta Empl_t$	Sales $Growth_t$	Sales $Growth_{t-1}$	DEBT $ASSETSPY_{t-1}$	PYQuick $Ratio_{t-1}$	Total $Return_t$	Size $(\$Mill)_{t-1}$
Mean	0.0543	0.1332	0.1809	0.2706	1.75	0.12	1,515
Median	0.0163	0.0709	0.0885	0.2369	1.11	0.03	89
Std. Dev.	0.2813	0.4592	0.5096	0.2418	2.04	0.62	9,073
Skewness	1.3506	3.7144	3.7013	1.312	3.26	1.50	20.8
Kurtosis	7.1816	26.2892	22.8948	5.32	15.69	6.17	692
Maximum	1.15	3.55	3.46	1.26	12.96	2.4	508,329
Minimum	−0.58	−3.11	−3.21	0.00	0.07	−0.99	0
Sample Number	77,711						

The table reports the descriptive statistics for the firm-year observations for the variables employed in this study over the period from 1983–2003. The definitions of all variables are reported in Table 2.

FIGURE 1
Frequency Distribution of the Annual Percentage Change in Employee Numbers for 77,711 Firm-Years over the Period 1983–2003



et al. 1997; Hamermesh 1989). The average and median growth rate in employee numbers together with the level of kurtosis in the distribution provides some support for the reliability of the employee number reported by Compustat firms.

IV. RESEARCH DESIGN AND RESULTS

H1: Loss Firms Have a Lower Level of Incremental Investment in Employees than Profit Firms

The first hypothesis is that the level of incremental investment in employees is lower for loss firms than economically equivalent firms reporting accounting profits. The first test that we perform is a simple univariate test. This is followed by a series of robustness tests.

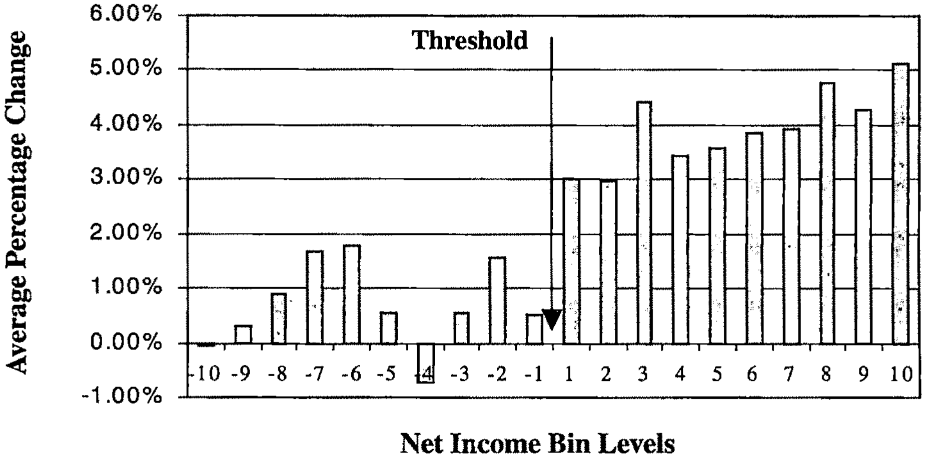
Univariate Test and Results

We first perform a univariate test that compares the percentage change in employees between firms reporting small profits for the year *t* and firms reporting small losses for the year *t*. To test the hypothesis the following variables are used. Following Burgstahler and Dichev (1997b) we use as our profit variable Net Income (*NI*, Compustat item #172) scaled by beginning-of-year total assets (*TA*, Compustat item #6). All firms are classified into profit bins and loss bins of interval width 0.005, consistent with prior research. Therefore, the first interval to the right of zero contains observations in the interval $\geq$ 0.00 and $<$ 0.005 of NI_t/TA_{t-1} (hereafter, *ProfitBinOne*). The first interval to the left of zero contains observations in the interval $<$ 0.00 and ≥ -0.005 of NI_t/TA_{t-1} (hereafter, *LossBinOne*). We individually examine the ten smallest profit bins and ten smallest loss bins. For each firm we calculate the percentage change in number of employees in year *t* (hereafter, $\Delta Empl_t$). We calculate the average $\Delta Empl_t$ for all the firms at the end of year *t* in each of the ten smallest *ProfitBins* and the ten smallest *LossBins*.

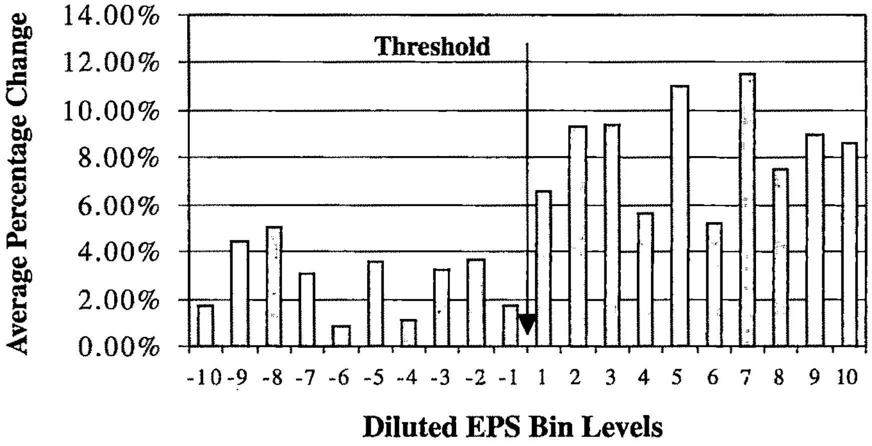
The results are reported in Figure 2, Panel A. The graph of the average percentage change in employees in each bin shows visually an economically significant shift when

FIGURE 2
Employment Changes

Panel A: The Average Annual Percentage Change in the Number of Employees by Firms as a Function of Different Levels of Net Income Either Side of the Zero Net Income Threshold



Panel B: The Average Annual Percentage Change in the Number of Employees by Firms as a Function of Different Levels of Diluted Earnings Per Share Either Side of the Zero Earnings Threshold



(*continued on next page*)

FIGURE 2 (continued)

Panel A represents the average percentage change of employees by firms at different profit intervals. The x-axis represents the profit intervals which are Net Income deflated by beginning period Total Assets. The distribution interval widths are 0.005. The first interval to the left of zero represents the average employee changes for all firms in the loss interval from < 0.00 to −0.005. The Threshold marks the point where Net Income is zero. The average employment changes in the bins either side of zero are 2.99 percent in *ProfitBinOne* (1) and 0.5 percent in *LossBinOne* (−1). The difference in the average employee changes between the two bins is 2.49 percent, which is statistically different at the 0.05 level (t-statistic of 2.01). The average employment changes across all ten profit bins is 4.59 percent and across all ten loss bins is 0.8 percent. The difference in the average employee changes between all ten profit bins and all ten loss bins is 3.79 percent which is statistically different at the 0.01 level (t-statistic of 10.15).

Panel B represents the average percentage change of employees by firms at different earnings per share levels. The x-axis is earnings per share. The distribution interval widths are one-cent intervals. The first interval to the left of zero represents the average employee changes for all firms with negative one-cent earnings per share. The employment changes in the bins either side of zero Threshold are 6.55 percent in *EPSProfitBin* (1) and 1.66 percent in *EPSLossBinOne* (−1). The difference in the average employee changes between the two bins is 4.89 percent, which is statistically different at the 0.05 level (t-statistic of 2.25). The average employment changes across all ten profit bins is 8.04 percent and across all ten loss bins is 2.8 percent. The difference in the average employee changes between all ten profit bins and all ten loss bins is 5.24 percent, which is statistically different at the 0.01 level (t-statistic of 6.31).

firms pass the zero Net Income threshold. Loss firms have a lower percentage change in employees than profit firms. The results show that firms in *ProfitBinOne* have an average percentage change in employees of 2.99 percent and firms in *LossBinOne* have an average percentage change in employees of 0.5 percent. The difference between the two bins is statistically significant at the 0.05 level (t-statistic of 2.01). As a robustness measure we test for a difference between bins where there should be none. Consistent with Burgstahler and Dichev (1997b) we examine the two adjacent profit bins to *ProfitBinOne* and the two adjacent loss bins to *LossBinOne*. There is no statistically significant difference between the bins adjacent to either the smallest profit or the smallest loss bin.

The results imply that the null hypothesis that investment in employees does not differ between those firms reporting a profit and those firms reporting a loss is rejected. We now subject this preliminary result to a series of robustness tests.

Is the Discontinuity at Zero in Employees Due to the Effects of Scale?

Durtschi and Easton (2005) show that the shapes of the frequency distributions of earnings metrics are affected by deflation (for example, using price or market capitalization). Therefore, as an alternate approach, results are reported for firms classified into bins based on Diluted Earnings Per Share (Compustat #57) in Figure 2, Panel B. The results show visually an economically significant shift in investment in employees when firms pass the zero Diluted EPS threshold. The shift is due to loss firms having a lower percentage change in employees than profit firms. The visual evidence is supported by statistical tests. There is a statistically significant difference at the 0.05 level (t-statistic of 2.25) in employee changes between *ProfitBinOne* (6.55 percent) and *LossBinOne* (1.66 percent).

Is the Discontinuity at Zero in Employees Due to a Shift in Economic Fundamentals?

The univariate tests do not control for economic fundamentals. We next attempt to control for the economic fundamental characteristics of the firms in the small profit and loss bins by estimating the following regression of employee demand:

$$\left.\begin{aligned}\Delta Empl_{it} = {} & \alpha + \beta_1 SalesGrowth_{it} + \beta_2 SalesGrowth_{it-1} + \beta_3 \Delta PROFIT_{it} \\ & + \beta_4 \Delta PYPROFIT_{it-1} + \beta_5 PROFIT_{it} + \beta_6 TOTRET_{it} + \beta_7 SIZE_{it-1} \\ & + \beta_8 PYQuickRatio_{it-1} + \beta_9 CHGQUICKPY_{it-1} + \beta_{10} CHGQUICKCY_{it} \\ & + \beta_{11} DEBTASSETSPY_{it-1} + \beta_{12} \sum_{Ind=1}^{19} DUMMIND \\ & + \sum_{L=1}^{5} \gamma_L *LossBins_t^{OnetoFive} + \sum_{P=6}^{10} \gamma_P *ProfitBins_t^{OnetoFive} + \varepsilon_{it}\end{aligned}\right\} H1 \quad (1)$$

where:

- *SalesGrowth* is the percentage change in sales (Compustat #12). This is included because it is represents change in demand for the firm's products and services and is considered to be the fundamental determinant of profitability and the level of investment a firm should make. Both current year and prior year sales growth are included because of the uncertainty as to the time lag between sales growth and change in employees.
- $\Delta PROFIT$ represents the change in Net Income (*NI*, Compustat item #172) scaled by beginning-of-year total assets (*TA*, Compustat item #6). This variable is included, in addition to our *SalesGrowth* variables, to control the normal fundamental impact of a change in earnings on the demand for labor. Both current year and prior year $\Delta PROFIT$ are included because of the uncertainty as to the time lag between profitability change and change in employees.
- $PROFIT_{it}$ represents the level of Net Income (*NI*, Compustat item #172) scaled by beginning-of-year total assets (*TA*, Compustat item #6). This is included as the level of profitability is likely to be a fundamental determinant of the level of investment in employees.
- $TOTRET_{it}$ represents the total annual share return for fiscal year t of firm i and proxies for future expected growth and for the effect of any omitted fundamental variables.[4]
- $SIZE_{it-1}$ is the market value of equity at the beginning of the year ranked into percentiles. This proxies for life cycle of a firm, which may influence employment growth rates and/or entry into a more mature, lower investment stage of the firm's life cycle. Finally, size proxies for the likelihood of firms facing cash flow shortages. Smaller firms are more likely to have cash flow problems leading them to reduce discretionary investments.
- $PYQuickRatio_{it-1}$ is the quick ratio at the beginning of the year, defined in Penman (2004) as the ratio of cash and equivalents (Compustat #1) plus Short-Term Investments (#2) plus Receivables (#193) to Current Liabilities (#5). This is included to proxy for short-term liquidity and to control for changes in employment due to cash flow shortages and short-term liquidity problems. As a further control, the change in short-term liquidity in both the current year (*CHGQUICKCY*) and the prior year (*CHGQUICKPY*) is also included. The change is simply measured as the percentage change in the quick ratio.

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[4] We also use abnormal return defined as the total return for firm i in fiscal year t less the return on the equally weighted market index with the same results.

- $DEBTASSETSPY_{it-1}$ is the ratio of total debt to total assets at the beginning of the year. This is included to proxy for long-term financing requirements and for reduced funds available for investment, which may trigger delay in hiring or retrenchment of employees.
- *DUMMIND* represents dummy variables for each industry using the four-digit Global Industry Classification Standard (GICS).
- $LossBins^{OnetoFive}$ *and* $ProfitBins^{OnetoFive}$: To test HI, we include in regression Model (1) ten dummy variables that take the value of 1 for those firms in each of the five small profit bins ($ProfitBins_t$) and each of the five small loss bins ($LossBins_t$) at the end of year *t*, and 0 otherwise. Firms are classified into five profit bins and five loss bins of interval width 0.005 consistent with the univariate test. For example in the estimated regression, there is a dummy variable *ProfitBinOne,* which takes the value of 1 for all observations in the interval $\geq$ 0.00 and $\leq$ 0.005 of $Net\ Income_t/TotalAssets_{t-1}$, and 0 otherwise, and so on for the other *ProfitBins*. Likewise, there is a dummy variable *LossBinOne*, which takes the value of 1 for all observations in the interval < 0.00 and ≥ -0.005 of NI_t/TA_{t-1}, and 0 otherwise, and so on for the other *LossBins.*

Labor has a fixed and variable component (Banker and Chen 2006; Horngren et al. 2006). The coefficients on the small *LossBins* and small *ProfitBins* can be interpreted as the incremental investment of small profit firms and small loss firms in fixed labor over and above the average firm. The base intercept, in OLS regression Model (1), α, represents our proxy for investment in fixed labor by the average firm and represents the percentage change in fixed labor employees due to normal random employee turnover.

We use employment decisions in respect of fixed labor to test our hypothesis in regard to the investment decisions of firms. This is because fixed labor is more likely than variable labor to represent an investment. Fixed labor, characterized as those employees who are not expected to change with short-term production, represent the committed resources invested to provide long-term productive capacity and management and administrative skills. In contrast variable labor, defined as those employees who change in proportion to changes in sales volume, represents flexible productive resources that managers can adjust easily in producing goods and services. In the regression the coefficient β_1 captures and controls the behavior of the firm with respect to the variable component of labor. Specifically, this represents the marginal percentage change in employees for a given percentage change in *SalesGrowth.*

Finally to reduce the influence of outliers we winsorize the dependent variable and each independent variable at the 1st and the 99th percentile; i.e., we set all observations beyond these tolerances to the 1st and the 99th percentile values, respectively. We calculate t-statistics using Newey-West corrected standard errors. Variable definitions are summarized in Table 2.

Regression Results

In Table 3 we present the parameter estimates and test results from regression Model (1). The magnitude of the coefficient on $SalesGrowth_t$ implies a 10 percent increase in sales, leads on average to a 3.2 percent growth in firm-level employment. The explanatory power of the regression is a reasonable 24 percent. The intercept in the regression is −1.4 percent. This represents the average level of employee turnover at a firm level. We estimate the regression without industry dummies and the results are qualitatively similar. Overall, the model appears to be reasonably well specified and provides a starting point for testing the hypothesis.

TABLE 2
Definition of Variables

Variable	Definition
$\Delta Empl_{it}$	The percentage change in number of employees from $t-1$ to t for firm i.
$SalesGrowth_{it}$	The percentage change in sales in period t for firm i.
$SalesGrowth_{it-1}$	The percentage change in sales in period $t-1$ for firm i.
$\Delta PROFIT_{it}$	The change in Net Income (NI, Compustat item #172) scaled by beginning-of-year total assets (TA, Compustat item #6).
$PROFIT_{it}$	Net Income (NI, Compustat item #172) scaled by beginning-of-year total assets (TA, Compustat item #6).
$PYQuickRatio_{it-1}$	The ratio of cash and equivalents plus short-term investments and receivables to current liabilities at end of year $t-1$ for firm i.
$CHGQUICKPY_{it-1}$	The percentage change in the quick ratio from $t-2$ to $t-1$ for firm i.
$CHGQUICKCY_{it}$	The percentage change in the quick ratio from $t-1$ to t for firm i.
$SIZE_{it-1}$	Market value at the end of the financial year $t-1$ ranked into percentiles.
$TOTRET_{it}$	Total return for fiscal year t of firm i.
$DEBTASSETSPY_{it-1}$	The debt to total asset ratio as at the end of the prior year.
Explanatory Variables	
ProfitBin?:	There are five separate profit bins for each 0.005 interval of Net $Income_t/Total\ Assets_{t-1}$ from 0 to 0.025. Example definitions of $ProfitBinOne^{NI}$ and $ProfitBinTwo^{NI}$ are below:
ProfitBinOne	Takes the value 1 for all observations in the $Net\ Income_t/Total\ Assets_{t-1}$ interval ≥ 0.00 and ≤ 0.005.
ProfitBinTwo	Takes the value 1 for all observations in the $Net\ Income_t/Total\ Assets_{t-1}$ interval > 0.005 and ≤ 0.01.
LossBin?:	There are five separate loss bins for each 0.005 interval of Net Income from 0 to -0.025. Example definitions of *LossBinOne* and *LossBinTwo* follow:
LossBinOne	Takes the value 1 for all observations in the $Net\ Income_t/Total\ Assets_{t-1}$ interval < 0.00 and ≥ -0.005.
LossBinTwo	Takes the value 1 for all observations in the interval < -0.005 and ≥ -0.010.
$PROFITtoLOSS_{it}$	Takes the value of 1 for those firms that crossed the threshold from a profit to a small loss in year t, and 0 otherwise. Small losses are all those observations in the $Net\ Income_t/Total\ Assets_{t-1}$ interval < 0.00 and ≥ -0.05.
$PYPROFITtoLOSS_{it-1}$	Takes the value of 1 for those firms that crossed the threshold from a profit to a small loss in the year $t-1$, and 0 otherwise.
DUMMERC	Takes the value of 1 for firms in four-digit CGIS industries in the top one-third of the distribution of earnings response coefficients.
DUMMTURN	Takes the value of 1 for firms in the top one-third of the distribution of share turnover, and 0 otherwise.
DUMMIND	Takes the value 1, and 0 otherwise, for each four-digit CGIS industry code.

The coefficients in the regression Model (1) for our test variables, each small profit-level bin and each small loss-level bin, represent the incremental effect of that bin on the average percentage change in the number of employees over and above the normal level of employee turnover. To test the hypothesis that loss firms have a lower level of investment than normal we use two benchmarks (1) all firms and (2) small profit firms.

The first benchmark we discuss is all firms. The results from estimation of regression Model (1) show that for each of the small loss bins there is a significantly lower average

TABLE 3
Model of Employee Demand

Variable	Expected Sign	Coefficient	t-statistic	Prob.
Intercept		−0.014556	−3.87*	0.0001
Control Variables				
$SalesGrowth_{it}$	+	0.325050	135.28*	0.0000
$SalesGrowth_{it-1}$	+	0.018066	9.21*	0.0000
$\Delta Profit_{it}$	−	−0.137271	−25.39*	0.0000
$\Delta Profit_{it-1}$	+	0.040037	7.27*	0.0000
$Profit_{it}$	+	0.064545	13.70*	0.0000
$TOTRET_{it}$	+	0.052488	36.06*	0.0000
$SIZE_{it-1}$	+	0.050618	12.17*	0.0000
$PYQuickRatio_{it-1}$	+	0.004183	10.78*	0.0000
$CHGQUICKPY_{it-1}$	+	−0.010060	−7.64*	0.0000
$CHGQUICKCY_{it}$	+/−	0.017834	13.38*	0.0000
$DEBTASSETSPY_{it-1}$	+/−	−0.037560	−6.01*	0.0000
Hypothesis 1				
ProfitBinFive	+/−	−0.008930	−1.27	0.2034
ProfitBinFour	+/−	−0.004981	−0.70	0.4826
ProfitBinThree	+/−	−0.008551	−1.17	0.2411
ProfitBinTwo	+/−	−0.002787	−0.37	0.7087
ProfitBinOne	+/−	−0.004742	−0.64	0.5208
LossBinOne	−	−0.027516	−2.46*	0.0136
LossBinTwo	−	−0.016058	−1.59	0.1114
LossBinThree	−	−0.028267	−2.76*	0.0056
LossBinFour	−	−0.033721	−3.29*	0.0010
LossBinFive	−	−0.018829	−1.73**	0.0836
Sample		77,711		
Adjusted R^2		0.2446		

The table reports the results from the estimation of OLS regression Model (1) for available firm-year observations across 1983 to 2003:

$$\begin{aligned}\Delta Empl_{it} = {} & \alpha + \beta_1 SalesGrowth_{it} + \beta_2 SalesGrowth_{it-1} + \beta_3 \Delta PROFIT_{it} + \beta_4 \Delta PYPROFIT_{it-1} \\ & + \beta_5 PROFIT_{it} + \beta_6 TOTRET_{it} + \beta_7 SIZE_{it-1} + \beta_8 PYQuickRatio_{it-1} + \beta_9 CHGQUICKPY_{it-1} \\ & + \beta_{10} CHGQUICKCY_{it} + \beta_{11} DEBTASSETSPY_{it-1} + \beta_{12} \sum_{Ind=1}^{19} DUMMIND \\ & + \sum_{L=1}^{5} \gamma_L *LossBins^{OnetoFive} + \sum_{P=6}^{10} \gamma_P *ProfitBins^{OnetoFive} + \varepsilon_{it}. \qquad (1)\end{aligned}$$

The dependent variable is the percent change in number of employees from $t-1$ to t. All independent variables are defined in Table 2. The independent variables from *ProfitBinFive* to *LossBinFive* represent ten individual dummy variables in OLS regression Model (1) that take the value 1 if a firm's profit or loss at the end of year t falls into the relevant interval, and 0 otherwise. The profit interval used is 0.005 of $Net\ Income_t/TotalAssets_{t-1}$. *ProfitBinOne* and *LossBinOne* represent firms that fall into the first profit or loss interval to the right and left of the zero threshold respectively. t-statistics are calculated using Newey-West corrected standard errors. Coefficient estimates that are significant at conventional levels (two-tailed test) are indicated with a * (5%) and ** (10%).

percentage change in the level of employees than the benchmark. The results are economically significant. The coefficient for *LossBinOne* implies that the difference in the average percentage change in the number of employees is 2.7 percent lower than normal. The magnitude of the coefficient on *LossBinOne* is representative of the other small loss bins.

The second benchmark, as a more direct test of our hypothesis, is small profit firms (*ProfitBinOne* to *ProfitBinFive*). First, note that the coefficients on all loss bins are statistically significantly lower than the intercept (the average firm). In contrast, none of the profit firms are statistically different from the intercept. This is consistent with the small profit firms being economically normal and the small loss firms having a lower than normal investment in labor. To more formally test our hypothesis, we examine whether there is a difference in investment in employees between the loss bins and the profit bins and whether this difference is due to a switch or a regime shift at the zero profit threshold. The results show that the coefficient on the *LossBinOne* is negative and statistically lower, using a Wald test, than that of the *ProfitBinOne*. More importantly there is a difference between a broader range of loss firms and a broader range of profit firms with the difference being attributable to a switch at the zero earnings threshold. This does not appear to be driven by a shift in economic fundamentals not captured by the model.

We find, in results not reported, that there is no statistical difference between *LossBinOne* and the other small loss bins from *LossBinTwo* to *LossBinFive*. Likewise, we find no statistical evidence of a difference between *ProfitBinOne* and all other profit bins from *ProfitBinTwo* through to *ProfitBinFive*. The only bins where there is a statistically significant difference is between *ProfitBinOne* and *LossBinOne*. The evidence is consistent with there being a difference in investment in employees between loss and profit firms. The difference is attributable to a lower investment than normal by firm reporting accounting losses with the regime shift occurring at the zero earnings threshold.

To address concerns raised by Durtschi and Easton (2005), that the shapes of the frequency distributions of earnings metrics are affected by deflation, we also classify firms into five small profit and five small loss bins using Diluted Earnings Per Share (Compustat #57) and unscaled Net Income (Compustat #172).[5] We then estimate regression Model (1) using in turn each of these different bin deflators. The results, not reported, are consistent with those reported above. They show an economically significant difference in investment between firms reporting small profits and firms reporting small losses.

In summary, this section provides evidence that firms reporting accounting profits and firms reporting accounting losses make economically significant different employment decisions after controlling for economic fundamentals. The difference is driven by the lower investment in employees than expected by firms reporting an accounting loss.

Analysis of Discontinued Operations

We have provided evidence of a discontinuity in employment changes between loss and profit firms at the zero earnings threshold. Our main explanation for this is that the zero earnings threshold acts as a trigger to exercise the abandonment option and divest unproductive investments. To provide support for this explanation we examine whether there is a discontinuity at zero in the percentage of firms that report discontinued operations. If the zero threshold acts as a catalyst to divest negative net present value projects, then we would expect the percentage of small loss firms that report a discontinued operation (*DO*, Compustat item #A66) to be greater than the percentage of small profit firms that report a discontinued operation.

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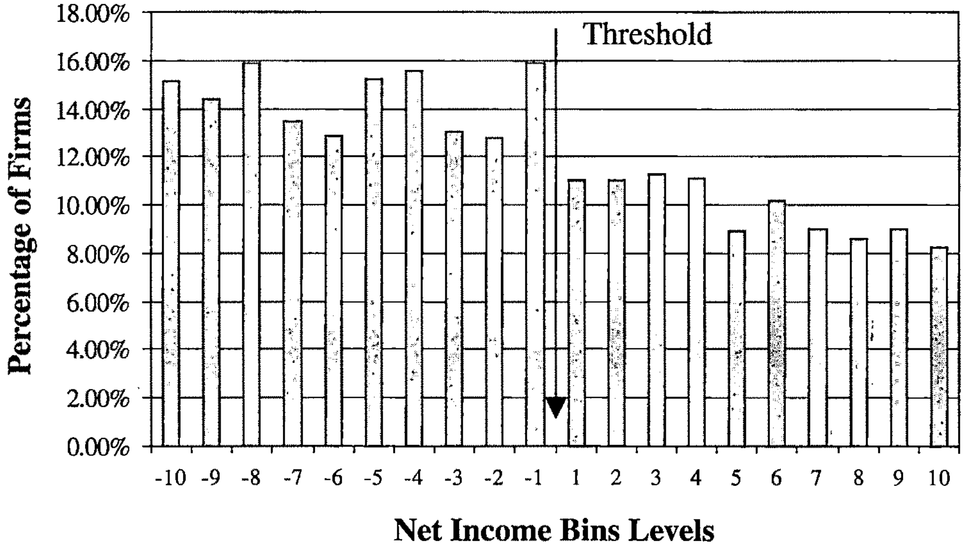
[5] Consistent with Durtschi and Easton (2005) firms are classified using Diluted Earnings Per Share into bins based on intervals of 1 cent and using undeflated Net Income into bins based on intervals of $100,000.

To examine this for each of our ten smallest profit bins and our ten smallest loss bins we calculate the proportion of firms in each bin interval that have reported a discontinued operation. We report results in Figure 3.

The graph of the proportion of firms with discontinuing operations in each bin shows visually an economically significant difference at the zero Net Income threshold. Note that all of the ten small loss bins report a greater percentage of discontinued operations than all of the ten small profit bins. The visual evidence is supported by statistical tests. The results show that there is a statistically significant difference at the 0.01 level (t-statistic of 3.36) between *ProfitBinOne* (11.00 percent) and *LossBinOne* (15.80 percent) in the proportion of firms that have discontinued operations.

In summary, across the range of profit or loss intervals examined the greatest shift in the percentage of firms reporting discontinued operations occurs at the zero earnings threshold. The evidence is consistent with there being a difference in the decision to discontinue operations between loss and profit firms attributable to the loss heuristic. This result is consistent with our results in regard to the impact of the loss heuristic on labor employment decisions and provides both context and robustness to these findings.

FIGURE 3
Percentage of Firms Reporting Discontinued Operations



The figure represents the average percentage of firms reporting discontinued operations at different profit intervals. The x-axis represents the profit intervals, which are Net Income deflated by beginning period Total Assets. The distribution interval widths are 0.005. The first interval to the left of zero represents the average employee changes for all firms in the profit interval from 0.00 to −0.005. The Threshold marks the point where Net Income is zero. The percentage of firms reporting discontinued operations in the bins either side of zero are 11.00 percent in *ProfitBin* (1) and 15.89 percent in *LossBin* (−1). The difference between the percentage of firms reporting discontinued operations between the two bins is 4.89 percent. This difference is statistically different at the 0.01 level (z-statistic of −3.36). The percentage of firms reporting discontinued operations across all ten profit bins is 9.66 percent and across all ten loss bins is 14.37 percent. The difference in the percentage of firms reporting discontinued operations between all ten profit bins and all ten loss bins is 4.71 percent, which is statistically different at the 0.01 level (z-statistic of 11.16).

Is There a Discontinuity in Employment Changes at the Zero Threshold for Cash Flow from Operations?

As another robustness test we examine whether there is a kink in employment changes at the zero threshold for cash flows (i.e., between firms reporting small negative cash flows and firms reporting small positive cash flows). If management is using the accounting loss heuristic as a decision rule, then we should observe a kink in employment changes in the earnings distribution but not in the cash flow distribution. To test for a kink in employment changes at the zero threshold for cash flows, both cash flows from operations and free cash flows are examined. Free cash flow is defined as the sum of cash flows from operations and investing activities.

We use as our sample those firm years subsequent to 1988 that report a Statement of Cash Flows. For the available firm years we use the variable Net Cash Flow from Operations (Compustat item #308) scaled by beginning-of-year total assets (*TA*, Compustat item #6). All firms are classified into positive and negative cash flow bins and loss bins of interval width 0.005 consistent with the approach for testing the earnings heuristic. We examine individually the ten smallest positive cash flow bins and ten smallest negative cash flow bins either side of zero.

Figure 4 shows the average percentage change in employees by firms at different intervals of cash flows from operations. In contrast to the earnings distribution, there does not appear to be any kink in employment changes at the zero threshold for cash flow from operations. There is no significant difference between the smallest positive cash flow bin (1.86 percent) and the smallest negative cash flow bin (1.71 percent) in the average employee changes (t-statistic of 0.0836). We also examine if there is a discontinuity in employee investment at the zero threshold for free cash flow. This was defined as Net Cash Flow from Operations (Compustat item #308) plus Net Cash Flow from Investing activities (Compustat item #311) scaled by beginning-of-year total assets (*TA*, Compustat item #6). In results not reported, no visual or statistical evidence of a shift at zero was found. For free cash flows, the difference between small positive cash flows (1.95 percent) and small negative cash flows (2.09 percent) in the average employee changes is 0.15 percent, which is not significantly different (t-statistic of 0.1528).

The finding that there is a kink in employment changes in the earnings distribution (as shown in Figure 2, Panel A) but not in the cash flow distribution (Figure 4) suggests that it is the accounting loss heuristic per se that is affecting the decision of corporate managers.

Firms that Cross the Threshold from a Profit to Loss (H2)

The above section provides evidence of a discontinuity in employment changes between loss and profit firms at the zero earnings threshold. Our main explanation for this discontinuity is that reporting a loss acts as a trigger to exercise the abandonment option and divest unproductive investments. As a more direct cause and effect test of this we examine whether firms' immediate reaction to the move from a profit to a small loss is the divestment of a greater number of employees than normal given the fundamental demand impact of such a change (H2).

To test H2 we extend our regression Model (1) to examine the employment decisions in year t of firms that have recently crossed the threshold from reporting a profit to reporting a small loss. The revised model is:

FIGURE 4
Employment Changes by Firms at Different Intervals of Cash Flows from Operations

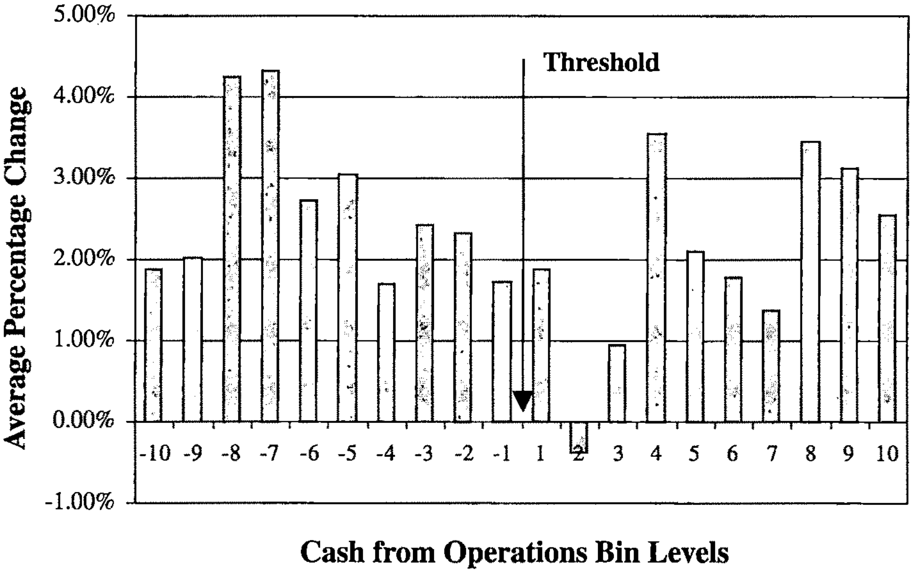


Figure 4 represents the average percentage change of employees by firms at different intervals of cash flows from operations. The x-axis represents the cash flow from operation intervals, which are cash flows from operations deflated by beginning period Total Assets. The distribution interval widths are 0.005. The first interval to the left of zero represents the average employee changes for all firms in the cash flow from operations interval from 0.00 to −0.005. The Threshold marks the point where cash flow from operations is zero. The employment changes in the bins either side of zero Threshold are 1.86 percent in *CashBin* (1) and 1.71 percent in *CashBin* (−1). The difference in the average employee changes between the two bins is 0.15 percent, which is not statistically different at the 0.05 level (t-statistic of 0.0836). The average employment changes across all ten positive cash flow bins is 2.1 percent and across all ten negative cash flow bins is 2.6 percent. The difference in the average employee changes between all ten positive cash bins and all ten negative cash bins is 0.5 percent, which is not statistically different (t-statistic of 0.84).

$$\begin{aligned}\Delta Empl_{it} = {} & \alpha + \beta_1 SalesGrowth_{it} + \beta_2 SalesGrowth_{it-1} + \beta_3 \Delta PROFIT_{it} \\ & + \beta_4 \Delta PYPROFIT_{it-1} + \beta_5 PROFIT_{it} + \beta_6 TOTRET_{it} + \beta_7 SIZE_{it-1} \\ & + \beta_8 PYQuickRatio_{it-1} + \beta_9 CHGQUICKPY_{it-1} + \beta_{10} CHGQUICKCY_{it} \\ & + \beta_{11} DEBTASSETSPY_{it-1} + \beta_{12} \sum_{Ind=1}^{19} DUMMIND \\ & + \beta_{13} PROFITtoLOSS_t + \beta_{14} PYPROFITtoLOSS_{t-1} + \varepsilon_{it}. \quad \Big\} \text{H2}\end{aligned} \tag{2}$$

In regression Model (2) the change in profit variable $\Delta PROFIT$ and the *SalesGrowth* variables control for the normal fundamental impact of a change in earnings on the demand for labor. We then use the dummy variables, $PROFITtoLOSS_{it}$ and $PYPROFITtoLOSS_{it-1}$, to examine whether firms that move from a profit to a small loss have reacted with a decrease in labor that is greater than normal. $PROFITtoLOSS_t$ takes a value 1 for firms that crossed the threshold from a profit to a small loss in the current year *t*. We use as our definition of small loss all firms that fall in the loss interval < 0.00 and ≥ -0.005 of

NI_t/TA_{t-1}. This interval represents our ten smallest loss bins we examined in Figure 1. The dummy variable $PYPROFITtoLOSS_{t-1}$ takes a value of 1 for firms that crossed the threshold from a profit to a small loss in the prior year. We predict that the coefficient on both these dummy variables will be negative as firms react to reporting a loss.

To test H2 we examine the employment decisions in year *t* of firms that have crossed the threshold in both the current year ($PROFITtoLOSS_t$) and the prior year ($PYPROFITtoLOSS_{t-1}$) because it is uncertain how long it will take firms to react to reporting a loss. The $PROFITtoLOSS_t$ firms that first report a loss in the year *t* will only learn during the year that earnings will be negative and therefore may not have sufficient time to adjust the firm's investment in fixed labor in year *t*. Therefore, as an additional test of H2 we also examine the $PYPROFITtoLOSS_{t-1}$ firms. These firms have had greater time to address the shock of moving across the threshold.

Finally, note that in all of the threshold crossing tests, the definition of the zero earnings threshold used is the profit measure Net Income (*NI*, Compustat item #172). The Basic Earnings per Share (Compustat item #58) and Diluted Earnings Per Share (Compustat item #57) zero earnings thresholds were also used with the same results.

Empirical Results: Threshold Changes from Profit to Loss (H2)

Table 4 reports the results from the estimation of regression Model (2). The coefficients on the control variables are similar to those from estimation of Model (1) and are therefore not reported. The coefficient estimate for the profit to small loss dummy variable ($PROFITtoLOSS_t$) of -0.8 percent is negative and statistically significantly different from zero. This is consistent with there being a decrease in fixed labor, in the year of the movement across the threshold, over and above that explained by economic fundamentals.

For firms that crossed the threshold in the prior year from a profit to a small loss ($PYPROFITtoLOSS_{t-1}$) the coefficient on the dummy variable of -2.3 percent (t-statistic -4.7) is negative and statistically and economically different from the benchmark. This is consistent with this set of firms decreasing their investment in fixed labor over and above economic fundamentals. The magnitude of the decrease in investment in fixed labor in the year following the movement over the zero earnings threshold (-2.3 percent) is significantly greater than the decrease in fixed labor in the year that firms cross the threshold (-0.8 percent). This is consistent with it taking some time for firms to decrease their investment in fixed labor.

The above approach effectively compares the employment decisions of firms that cross the threshold from a profit to a small loss to a benchmark determined by the average of all firms. As a robustness measure, we compare the employment changes of firms that crossed the threshold to a benchmark of firms with similar decrease in earnings that did not pass the threshold and remained in the profit group. We approach this by classifying firms that crossed the threshold from a profit to a small loss into quartiles based on the magnitude of the earnings decrease.[6] These are our test quartiles and are labeled $PROFITtoLOSS^{QUARTILEONE}$ through to $PROFITtoLOSS^{QUARTILEFOUR}$. The same quartile breakpoints are then used to classify into quartiles, firms that had an earnings decrease but that did not cross the threshold. These are our benchmark quartiles and are labeled $BENCH^{QUARTILEONE}$ through to $BENCH^{QUARTILEFOUR}$. We then adapt regression Model (2) and use dummy variables for each test quartile and each benchmark quartile to examine whether, for the same

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[6] The magnitude of earnings decrease is measured as the change in Net Income (*NI*, Compustat item #172) in year $t-1$ scaled by beginning-of-year total assets (*TA*, Compustat item #6). We use quartile breakpoints from the population of all firms that have an earnings decrease in year $t-1$.

TABLE 4
Employee Demand by Firms that Have Crossed the Threshold from a Profit to a Small Loss

Variable	Expected Sign	Coefficient	t-statistic	Prob.
Intercept	+/−	−0.014589	−3.89	0.0001
Control Variables				
Not reported				
Hypothesis 2				
$PROFITtoLOSS_t$	−	−0.00834	−1.79**	0.0788
$PYPROFITtoLOSS_{t-1}$	−	−0.02364	−4.78*	0.0000
Sample Size		77,711		
Adjusted R^2		0.2449		

The table reports the results from the estimation of OLS regression Model (2) for available firm-year observations across 1983 to 2003:

$$\begin{aligned}\Delta Empl_{it} = {} & \alpha + \beta_1 SalesGrowth_{it} + \beta_2 SalesGrowth_{it-1} + \beta_3 \Delta PROFIT_{it} + \beta_4 \Delta PYPROFIT_{it-1} \\ & + \beta_5 PROFIT_{it} + \beta_6 TOTRET_{it} + \beta_7 SIZE_{it-1} + \beta_8 PYQuickRatio_{it-1} + \beta_9 CHGQUICKPY_{it-1} \\ & + \beta_{10} CHGQUICKCY_{it} + \beta_{11} DEBTASSETSPY_{it-1} + \beta_{12} \sum_{Ind=1}^{19} DUMMIND \\ & + \beta_{13} \mathrm{PROFITtoLOSS}_t + \beta_{14} PYPROFITtoLOSS_{t-1} + \varepsilon_{it}. \end{aligned} \tag{2}$$

The dependent variable is the percent change in number of employees from $t-1$ to t. All independent variables are defined in Table 2. The results for the control variables are not reported. t-statistics are calculated using Newey-West corrected standard errors. Coefficient estimates that are significant at conventional levels (two-tailed test) are indicated with a * (5%) and ** (10%).

quartile of earnings decrease, the firms that crossed the threshold from a profit to a small loss have a greater negative change in labor than the benchmark firms. We examine each quartile separately and therefore estimate four regressions.[7] In results not reported, we find that across all quartiles of earnings decreases, the firms that switch from reporting a profit to reporting a small loss, have statistically significantly greater negative change in labor than the benchmark firms.

In summary, the results from this section are consistent with a switch from reporting a profit to reporting a loss having a statistically significant and economically important

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[7] As an example, to examine the incremental effect of the loss heuristic on firms for which the magnitude of the earnings decrease is in the smallest quartile, the following regression was estimated:

$$\Delta Empl_{it} = \alpha + \beta_c \sum_{c=1}^{12} ControlVariables + \beta_{13} BENCH^{QUARTILEONE} + \beta_{14} PROFITtoLOSS^{QUARTILEONE} + \varepsilon_{it}$$

where $BENCH^{QUARTILEONE}$ is a dummy variable that takes the value 1 for those firms that did not cross the threshold and for which the magnitude of the earnings decrease is in the smallest quartile, and 0 otherwise. $PROFITtoLOSS^{QUARTILEONE}$ is a dummy variable that takes the value 1 for those firms that crossed the threshold and for which the magnitude of the earnings decrease is in the smallest quartile, and 0 otherwise. We then test whether the coefficient β_{14} is negative and larger than the coefficient β_{13}.

incremental negative effect on employment decisions over and above economic fundamentals. This result is robust to a number of specification tests and holds across different levels of economic activity.

Variation in the Cross-Section

The above sections present results consistent with the loss heuristic acting as a trigger to exercise the abandonment option. In this section we examine whether the magnitude of the divestment on crossing the threshold from a profit to a small loss varies in the cross-section as predicted by H3 and H4. We approach this by extending our regression Model (2) and examine whether the magnitude of the coefficient on the variable $PROFITtoLOSS_t$ (the profit to small loss firms) varies in the cross-section.

Large Firms as a Proxy for Inefficient Investment (H3)

We predict that large firms are more likely to divest when they pass the threshold as they are more likely to have unprofitable projects (H3). We employ a dummy variable (*LARGE*) that takes the value of 1 if the firm is above the 50th percentile of market capitalization, and 0 otherwise. To examine the size effect, Model (2) is simply extended by including the dummy variable *LARGE* in the regression and an interaction variable between those firms that moved from a profit to a small loss and *LARGE* (i.e., the interaction variable is $PROFITtoLOSS_t{*}LARGE$). The estimated regression is as follows:

$$\begin{aligned}\Delta \mathrm{Empl}_{it} = \alpha + \beta_c \sum_{c=1}^{12} ControlVariables + \beta_{13} PROFITtoLOSS_t + \beta_{14} LARGE_{t-1} \\ + \beta_{15} PROFITtoLOSS_t{*}LARGE_{t-1} + \varepsilon_{it}. \qquad (3)\end{aligned}$$

The results are reported in Panel A of Table 5. For ease of presentation, the results in respect of the control variables are not reported. The coefficient on the variable $PROFITtoLOSS_{it}{*}LARGE_{it-1}$ is negative and statistically significant. This is consistent with the hypothesis that large firms are more likely to be influenced by reporting accounting losses and accordingly divest a greater amount of fixed labor.

Share Price Pressure (H4)

We predict that the loss heuristic is likely to have greater influence on those firms whose share price is more sensitive to earnings (H4). We operationalize this prediction by using firms in industries that have both a high earnings response coefficient and are more likely to be held by short-term investors. Bushee (1998) shows that short-term institutional investors are more sensitive to current period earnings that long-term future earnings.

We estimate the sensitivity of share price to earnings for each four-digit GICS Industry. This is approached by using pooled cross-section and time-series data to estimate the earnings response coefficient for each industry where annual abnormal share returns and unexpected earnings are the dependent and independent variables, respectively. We then use firms in those industries with earnings response coefficients in the top third of the distribution as a proxy for those firms with greater share price sensitivity to earnings changes (*DUMMERC*). As a proxy for firms that are more likely to be held by short-term investors, we use the level of trading volume. The greater the trading volume in a share the more likely it is to be held by transient institutional investors. We measure the trading volume in a firm's shares in the year $t-1$. Those firms with turnover in the top third of the distribution are then used as a proxy for those firms held by short-term investors (*DUMMTURN*).

TABLE 5
Employee Demand by Large Firms and Share-Price Sensitive Firms that Cross the Threshold from a Profit to a Small Loss

Variable	Expected Sign	Coefficient	t-statistic	Prob.
Panel A: Large Firms				
Intercept	+/−	−0.006585	−2.03*	0.0418
LARGE	+	0.014760	3.38*	0.0002
$PROFITtoLOSS_t$	−	−0.000955	0.13	0.8900
Hypothesis 4				
$PROFITtoLOSS_t*LARGE$	−	−0.015641	−1.64**	0.094
Panel B: Share-Price Sensitive Firms				
Intercept	+/−	0.004566	0.942	0.3458
DUMMERC	+/−	−0.020393	−4.17*	0.0000
DUMMTURN	+/−	−0.006363	−1.85**	0.0641
$PROFITtoLOSS_t$	−	−0.001851	−0.35	0.7256
Hypothesis 5				
$PROFIT\ toLOSS_t*DUMMTURN*DUMMERC$	−	−0.036311	−2.54*	0.0110
Adjusted R^2		0.2438		

Panel A reports the results from estimate of OLS regression Model (3). The model is estimated for available firm-year observations across 1983 to 2003:

$$\Delta Empl_{it} = \alpha + \beta_c \sum_{c=1}^{11} ControlVariables + \beta_{13} PROFITtoLOSS_t + \beta_{14} LARGE_{it-1} + \beta_{15} PROFITtoLOSS_{t-1} * LARGE_t + \varepsilon_{it}. \quad (3)$$

Panel B reports the results from estimate of the following OLS regression model for available firm-year observations across 1983 to 2003:

$$\Delta Empl_{it} = \alpha + \beta_c \sum_{c=1}^{12} ControlVariables + \beta_{13} PROFITtoLOSS_t + \beta_{14} DUMMERC + \beta_{15} DUMMTURN + \beta_{16} PROFITtoLOSS_t *DUMMERC* DUMMTURN + \varepsilon_{it}.$$

The dependent variable for both regressions is the percentage change in number of employees from $t-1$ to t. All independent variables are as described in Table 2. Only the coefficients on the threshold and interaction variables are reported. The coefficients on the base control variables are not reported. Estimates that are significant at conventional levels (two-tailed) are indicated with * (5%) and ** (10%).

To examine the share price effect on divestment of labor we simply extend Model (2) by including the dummy variables *DUMMERC* and *DUMMTURN* in the regression and an interaction variable capturing the firms in these categories that move from a profit to a small loss (i.e., the interaction variable is $PROFITtoLOSS_t*DUMMERC*DUMMTURN$).

The results are reported in Panel B of Table 5. The coefficient on the hypothesized variable ($PROFITtoLOSS_t*DUMMERC*DUMMTURN$) is negative and statistically significant. This is consistent with the hypothesis that firms whose stock price is more sensitive to earnings are more likely to be influenced by reporting accounting losses and accordingly divest their investment in fixed labor.

V. CONCLUSION

In this study we examine the impact of reporting an accounting loss on investment in employees over the period 1983 to 2003. We find that there is a significant discontinuity around zero in the level of investment in labor between small profit and small loss firms. Consistent with our hypothesis that this is due to the exercise of the abandonment option we find that when firms first switch from reporting a profit to a loss they have a greater decrease in investment in labor than expected given the change in their economic fundamentals. Cross-sectional tests provide further insights into the impact of the loss heuristic on the incentive to divest employees. We find the impact is stronger for large firms, which we argue are likely to be more prone to over-investment problems. We also find the divestment is greater for firms with a high earnings response coefficient and high share turnover.

This paper provides insights into the impact of reporting a loss on the management of a firm's operations. The main contribution of this study is to show that the widely used categorization of firms into profit or losses is a powerful heuristic that can have significant economic consequences other than creating incentives for earnings management. We show that the loss heuristic also acts as a trigger for firms to divest or abandon unproductive investments and discontinue operations.

There are a number of caveats. We have argued that the main explanation for our result is that reporting a loss acts as a disciplinary event that reduces agency problems, by for example acting as an external cue for an increase in the monitoring of managers. If this is the explanation for the divestment, then the effects of the loss heuristic should lead to an improvement in investment efficiency of the firm. We have not examined this and therefore some caution should be exercised in accepting our agency explanation for the main result. Future research could therefore examine whether the actions of management, as a consequence of the disciplinary effects of reporting a loss, lead to an improvement in the long-run operating performance of the firm. Future research could also examine how the impact of reporting an accounting loss on divestment varies across different types of factors of production such as capital expenditure and research and development. Agency costs, such as over-investment, could vary across different types of factors of production.

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Is Openness Penalized? Stock Returns around Earnings Warnings

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ABSTRACT: Prior research finds that firms warning investors of an earnings shortfall experience lower returns than non-warning firms with similar risks and earnings news. Openness thus appears to be penalized by investors. Yet, this finding may be due to a self-selection bias that occurs when firms with a larger amount of unfavorable non-earnings news ("other bad news") are more likely to warn. In this paper I use a Heckman selection model to infer the amount of other bad news and document that, on average, warning firms have a larger amount of other bad news than non-warning firms. After controlling for this effect, I find that warning firms' returns remain lower than those of non-warning firms in a short-term window ending five days after earnings announcement. When this window is extended by three months, however, warning and non-warning firms exhibit similar returns. My evidence suggests that openness is ultimately not penalized by investors.

Keywords: *earnings warning: self-selection; warning effect; voluntary disclosure.*

I. INTRODUCTION

This paper examines whether firms that warn of an earnings shortfall experience lower stock returns than firms that have similar risks, earnings news, and non-earnings news but do not warn. After controlling for risks and earnings news, Kasznik and Lev (1995; hereafter, KL) find that warning firms' returns are significantly lower than the returns of those that likely anticipate an earnings shortfall but do not warn ("non-warning firms"). This finding has been interpreted as a market penalty for openness.[1] If investors indeed penalize openness, then firms that face an earnings shortfall would be less willing to warn and, as a result, the frequency of warnings should diminish. Surprisingly, the number of warnings increased in the past decade (see Figure 1).

In this paper I examine whether KL's finding is due to unfavorable non-earnings news, referred to as "other bad news," that affects managers' warning decisions and investors'

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[1] See *The Economist* (1994) and Core (2001, 448).

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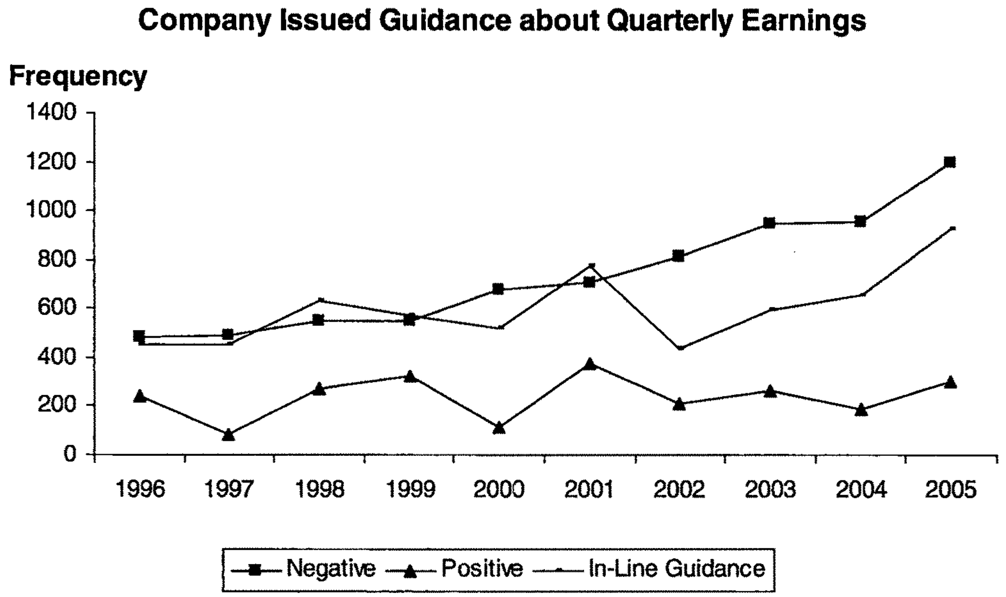
FIGURE 1
Earnings Guidance in the Confession Season



The graph shows the number of negative, positive, and in-line guidelines given by U.S. companies about quarterly earnings. These guidelines are issued after the beginning of the third fiscal month in the so-called "confession season." The data source is the First Call Company Issued Guidelines (CIG) database. First Call collects company guidelines from press releases and interviews, compares them with existing market expectations, and codes them as negative, positive, or in-line guidance (i.e., confirming guidance).

stock valuation, but is omitted from the researchers' return analysis. In addition, I examine whether stock prices immediately impound such news. Examples of other bad news include the discontinuation of new product development, plans for store closings, trouble with alliances, change in management, and lawsuits.[2] Such news is unobservable to researchers without incurring substantial data-collection costs. Using a Heckman selection model that addresses the unobservability problem, I find that, on average, warning firms have a larger amount of other bad news than non-warning firms. After controlling for risks, earnings news, and other bad news, I find that warning firms' returns remain lower than those of non-warning firms in a short-term window that ends five days after earnings announcement. When this window is extended by three months ("long-term"), however, warning and non-warning firms exhibit similar returns. Openness is ultimately not penalized by investors.

My tests proceed in two steps. First, as with KL, I do not control for other bad news. Warning firms' returns are, on average, 10.1 percent lower than those of non-warning firms that have similar risks and earnings news. This return difference, referred to as the "between-group return difference," does not change across the short- to long-term windows, suggesting that warning firms are correctly priced relative to non-warning firms—there is no between-group mispricing.[3]

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[2] Firms often disclose a great deal of other news along with earnings surprises in earnings warnings and earnings announcements. For example, when Rambus Inc. warned on January 14, 1999 (*Business Wire*) about earnings in the next three quarters, it also disclosed the discontinuation of the development of a prospective product.

The above negative between-group return difference, however, is *not* evidence of a market penalty for warning. It may be that managers are more likely to warn when they have a larger amount of other bad news, all else being equal. That is, firms self-select into the warning or non-warning groups depending on the amount of other bad news. If this is the case, then the average return of warning firms *should* be lower than that of non-warning firms, *ceteris paribus*. After removing this "self-selection effect," any remaining between-group return difference is the "warning effect." In other words, the between-group return difference consists of a self-selection effect and a warning effect. The warning effect is the difference between warning firms' returns and what the returns would have been had these firms not warned. Intuitively speaking, the warning effect estimates the average return difference between warning and non-warning firms after controlling for risks, earnings news, and other bad news. It is the warning effect, rather than the between-group return difference, that measures the market penalty for warning.

In my second step I add the control for other bad news. I find that the warning effect in the short-term window is significantly negative at −6.4 percent, but disappears in the long-term window. Subtracting the warning effect from the between-group return difference, I estimate the self-selection effect to be −3.7 percent in the short-term and about −10 percent in the long-term. The negative self-selection effect suggests that, on average, warning firms have a larger amount of other bad news than non-warning firms. Taken together, my results indicate that the negative between-group return difference in the short-term is due to both a negative warning effect and a negative self-selection effect, but the difference in the long-term is due purely to the self-selection effect. Therefore, the decision to warn is ultimately not penalized by investors.

Further, I investigate why a warning penalty exists in the short-term window. My evidence suggests that investors initially do not fully adjust stock prices for other bad news. By the end of the short-term window, investors (who typically have a larger information set than researchers) may observe other bad news or they could infer such news using the following logic. Suppose the amount of bad news is all that matters when managers decide whether to warn and—because of litigation costs from withholding bad news—a firm is more likely to warn if it has a larger amount of *total* bad news. If a firm warned even though its earnings shortfall is small, then the firm is likely to have a larger amount of other bad news than a warning firm that has a large earnings shortfall. Likewise, if a firm did not warn despite its large earnings shortfall, the firm is more likely to have a larger amount of other good news (or a smaller amount of other bad news) than a non-warning firm that has a small earnings shortfall. Hence, investors could infer the amount of other bad news about each firm and should adjust the stock price for such news.

In the short-term I find that while investors react more negatively to warning firms with more other bad news than to warning firms with less other bad news, they do not *completely* adjust for the difference in such news. For non-warning firms, on the other hand, investors initially increase, rather than decrease, the stock prices of those that have more other bad news relative to those that have less, and these price adjustments are later reversed. Thus, in the short-term investors' responses to other bad news are incomplete within the warning group and directionally incorrect within the non-warning group. I refer to this phenomenon as "within-group mispricing."[4] As a result, firms with a large amount of other bad news, which therefore tend to warn, are worse off in the short-term for having warned than for being silent.

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[3] This statement holds for the long-term windows that extend the short-term window by one to 12 months.

My paper makes four contributions to the literature. First, the evidence that openness is ultimately not penalized is relevant to firm managers. Managers routinely face the decision of being open versus being silent about forthcoming earnings shortfalls and are concerned about investors' responses to their disclosure decisions. My study adds to the literature beyond Shu (2003) and Xu (2003) who address a similar research issue. Shu (2003) controls for self-selection in the short-term but does not examine the long-term. Xu (2003) examines the long-term but does not control for self-selection. In addition, my study uses a substantially larger sample in the recent time period, thereby increasing statistical power and providing more current evidence than either Shu (2003) or Xu (2003).

Second, I document within-group mispricing; such evidence is unique in the literature. Accounting and finance studies offer much evidence for market overreaction or underreaction to firms that go through particular corporate events. For example, earnings announcements (Bernard and Thomas 1989, 1990), dividend initiations and omissions (Michaely et al. 1995), IPOs (Loughran and Ritter 1995, 2000), tender offers (Ikenberry et al. 1995), and stock splits (Ikenberry and Ramnath 2002). These studies document mispricing of the event firms relative to other firms, suggesting between-group mispricing. In contrast, what I find in this study is *within-group* mispricing.[5]

The third contribution is in my application of Heckman selection models. While previous studies have used selection models,[6] my application is new in two ways. Foremost, I decompose the between-group return difference into a warning effect and a self-selection effect. This decomposition is fundamental in studies that address self-selection. My study is the first of which I am aware that uses this relation explicitly to design empirical tests. Furthermore, I draw inferences about stock price adjustments for other bad news from the coefficients on the inverse Mills ratio (which is used to control for self-selection), and examine these coefficients across various windows, whereas previous studies largely stop short of interpreting these coefficients. My application also goes beyond the commonly used treatment-effect regression (Greene 2003) by allowing the warning and non-warning groups to have different coefficients on the inverse Mills ratio. Overall, the method that I employ can potentially be used to address other accounting issues.

Finally, my study serves as an example of how a failure to control for self-selection can lead to drastically different conclusions. Maddala (1991, 799 and 801) pointed out that the accounting studies that use selection models "thus far do not show any strong evidence of selection bias" because the conclusion with the control for self-selection is the same as the conclusion without such a control; therefore, "by definition, there is no selection bias." His criticism remains applicable to the subsequently published accounting studies (of which I am aware) that use selection models. My study shows that without control for self-selection, one would conclude that openness is penalized, when in fact it is not.

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[4] I thank an anonymous referee for this insight. A trading strategy that exploits within-group mispricing earns a mean abnormal return of 2.3 percent from the warning group and 2.0 percent from the non-warning group in the three months after the event quarter. Such abnormal returns, however, may not be inconsistent with market efficiency when transaction costs are considered (Korajczyk and Sadka 2004).

[5] The total between-group return difference does not change over time, but its two components shuffle from the short- to long-term. When within-group mispricing occurs, warning or non-warning firms' coefficients on the inverse Mills ratio change from the short- to long-term, causing the self-selection effect to change over time.

[6] See, e.g., Shehata (1991), Hogan (1997), Leuz and Verrecchia (2000), Beatty et al. (2002), Weber and Willenborg (2003), and Khurana and Raman (2004).

The rest of the paper proceeds as follows. Section II reviews prior research. Sections III through VII present the econometric model, empirical predictions, variable identifications and measurements, data, and test results. Section VIII concludes.

II. PRIOR RESEARCH

The most popular reason for voluntary bad-news disclosure is to reduce expected settlement costs in class action lawsuits associated with price declines (Skinner 1994, 1997). KL find evidence that is consistent with this argument. Using 219 warning events about large earnings surprises, they find that in the face of bad news a firm's characteristics suggesting higher litigation risk or costs are positively associated with the likelihood of warning. Other studies report mixed evidence on this argument. For example, Soffer et al. (2000), Baginski et al. (2002), and Field et al. (2005) provide supportive evidence, whereas Francis et al. (1994) and Johnson et al. (2001) do not.

The second reason for voluntary bad-news disclosure is to maintain a strong reputation with analysts and fund managers (Skinner 1994). This argument implicitly views a firm's disclosure decision as a mid-game phenomenon in a multi-period game. Following this conjecture, I expect that firms with many voluntary disclosures in the past are more likely to warn in the current quarter to maintain a reputation for transparency. Similarly, firms with higher analyst following have a higher propensity for issuing warnings because the damage caused by being silent would be greater.

Several studies have examined the capital-market consequences of warnings. KL find that warning firms experience larger price declines than non-warning firms in the window that covers both the warning and the subsequent earnings announcement. This finding is confirmed by Atiase et al. (2006) in a large sample that has small earnings shortfalls. KL tentatively attribute their finding to the possibility that warnings signal a permanent earnings decline and also propose market overreaction as an alternative explanation.

Two subsequent studies examine a research question similar to mine. Shu (2003) uses 104 warning firms that have large earnings shortfalls in the 1994–1995 quarters. She finds that warning firms' short-term returns are weakly significantly lower than those of non-warning firms, but the warning effect is positive after she controls for firms' self-selection. Xu (2003) collects 151 warnings about large earnings shortfalls during 1991–1994. She finds that warning firms have larger downward analyst revisions and lower operating income than non-warning firms in the year after the event quarter, supporting KL's permanent-earnings-decline argument. In the short-term return test, she finds that warning firms have weakly significantly lower returns than non-warning firms after controlling for self-selection. Moreover, she reports that warning firms earn lower excess returns than non-warning firms over a size-M/B-momentum return benchmark in the 12 to 36 months *after* the event-quarter, concluding that investors have, in fact, under-reacted to warnings.

These studies do not provide a clear answer to my research question. In the short-term window, Shu (2003) and Xu (2003) report contradictory findings. In the long-term window, Xu (2003) does not control for self-selection and the drift she documents is intriguing. It is thus unclear whether a firm is worse off in the long run for issuing a warning, given its risks, earnings news, and non-earnings news known to the manager at the disclosure decision.

III. ECONOMETRIC MODEL

To determine whether the decision to warn is penalized by investors, I use a Heckman model (Heckman 1979, 2001) to control for the effect of firms' self-selection.

Heckman Model

I model investors' decisions and managers' warning choices in the following system:

$$R_{1i} = \alpha_1 + X_i\beta + v_{1i} \text{ (data are observed only when } Warn_i^* > 0\text{);} \quad (1)$$

$$R_{0i} = \alpha_0 + X_i\beta + v_{0i} \text{ (data are observed only when } Warn_i^* \leq 0\text{);} \quad (2)$$

$$Warn_i^* = Z_i\gamma + \varepsilon_i. \quad (3)$$

A firm has two possible states: warning or non-warning. Equations (1) and (2) model stock returns (R) in the warning state and non-warning state for the *whole population*, respectively. X is the row vector of control variables that include risk factors and earnings news (β is the column vector of coefficients), implying that v_1 and v_0 represent non-earnings news to investors but are unobservable to researchers. The warning effect is $\alpha_1 - \alpha_0$. In reality, only warning firms are observed for estimating Equation (1) and only non-warning firms are observed for estimating Equation (2), presenting a challenge in estimating the warning effect.

Equation (3) is the warning model. *Warn** is a continuous latent variable known to a manager but *not* to researchers, for example, a measure of the pressure that the manager feels about issuing a warning. If the measure is higher than a threshold (normalized to 0 in the model), then the manager issues a warning and the binary variable *Warn* is 1. Otherwise, the manager keeps silent and *Warn* is 0. What researchers observe is merely *Warn*—whether a firm warns. Assuming that Z is the row vector of all the factors that affect a manager's warning decision and are observable to researchers, such as the earnings shortfall, ε then represents the factors that affect the manager's decision but are *unobservable* to researchers.

Unlike in a standard regression, in Equation (3) after γ is estimated, the residual corresponding to ε_i is unobservable because $Warn_i^*$ is unobservable. One can make the following probabilistic statements about ε_i after observing $Warn_i$ and $Z_i\gamma$. Given that a firm warned, ε_i is likely to be high when $Z_i\gamma$ is low, thereby triggering the threshold to warn. Given that a firm did not warn, ε_i is likely to be low when $Z_i\gamma$ is high, making the firm stay below the threshold. Therefore, within both the warning group and the non-warning group, high ε_i is associated with low $Z_i\gamma$ and ε_i varies within each group as long as Z_i varies.

The three unobservables—v_1, v_0, and ε—are the focus of the Heckman model. The Heckman literature traditionally assumes that the choice model can be implemented by fitting data into the cumulative probability function of the standard normal distribution and that (ε, v_1) and (ε, v_0) each follow a joint-normal distribution with covariances $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$, respectively. If the sets of non-earnings news represented by v_1 and v_0 do not intersect at all with the set of factors represented by ε, then $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$ are 0 and the whole system collapses to stand-alone regressions. Otherwise, the three equations are intertwined as follows.

Using the properties of truncated normal distributions, one can mathematically derive the expected return of a firm based on whether the firm has warned and the observables X and Z (Greene 2003, 759). On observing a warning, investors use Equation (4) to assess stock value; for a firm that does not warn, investors use Equation (5). The last terms in Equations (4) and (5) are the "self-selection terms," where $\phi(\cdot)$ and $\Phi(\cdot)$ are the standard normal p.d.f. and c.d.f., respectively:

$$E(R_{1i}|_{warm_i=1}) = \alpha_1 + X_i\beta + E(v_{1i}|_{\varepsilon_i>-Z_i\gamma}) = \alpha_1 + X_i\beta + \sigma_{\varepsilon v_1}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}; \tag{4}$$

$$E(R_{0i}|_{warm_i=0}) = \alpha_0 + X_i\beta + E(v_{0i}|_{\varepsilon_i\leq-Z_i\gamma}) = \alpha_0 + X_i\beta + \sigma_{\varepsilon v_0}\frac{-\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}. \tag{5}$$

Interpretation of the Self-Selection Terms

Assume that managers are more likely to warn when they have more other bad news for investors and less likely to warn when they have more other good news (i.e., less other bad news). In this case, ε is higher in the presence of a larger amount of other bad news. If stock prices fully impound other bad news, then v_1 and v_0 should each be lower for firms with a larger amount of bad news and thus a higher ε. Therefore, $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$ are negative. The negative covariances are due to the factors (unobservable to researchers) that *both* managers and investors consider in their respective decisions; these factors are *other bad news*.[7]

The self-selection terms in Equations (4) and (5) are investors' price adjustments for a firm's other bad news. The signs of $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$ determine the direction of price adjustments for each group. Because $\phi(\cdot)$ and $\Phi(\cdot)$ are positive functions, negative $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$ mean that the price adjustment for a warning firm is *downward* and that for a non-warning firm *upward*. Within the warning group, the amount of price adjustment $\left(\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}\right)$ decreases with $Z_i\gamma$ and thus increases with ε_i (see Appendix A). Similarly, within the non-warning group, the amount of price adjustment $\left(\frac{\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}\right)$ increases with $Z_i\gamma$ and thus decreases with ε_i. The above relations indicate that within the warning group a firm that has a larger amount of other bad news (i.e., a higher ε_i) receives a larger price cut than a firm that has less such news. Similarly, within the non-warning group a firm with a larger amount of other good news (i.e., less other bad news—a lower ε_i) receives a larger price increase than a firm with less such news. I follow the Heckman literature and label $\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ and $\frac{-\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}$ as the "inverse Mills ratio" (represented by variable *Mill*) for a warning firm and a non-warning firm, respectively.

Empirical Selection Model and Its Comparison with the OLS Model

Equations (4) and (5) represent two regressions that can consistently estimate the true coefficients α_1, α_0, and β. I combine these two regressions to form Equation (6), which is my application of the Heckman selection model. Here, $\theta_{TT} = \alpha_1 - \alpha_0$, estimating the warning effect.

$$\begin{aligned} R_i = {} & \alpha_0 + \theta_{TT}\,Warn_i + X_i\beta + \sigma_{\varepsilon v_1}Mill_i{*}Warn_i \\ & + \sigma_{\varepsilon v_0}Mill_i{*}(1 - Warn_i) + w_i. \end{aligned} \tag{6}$$

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[7] Other factors (unobservable to researchers) that either managers or investors but not both consider do not contribute to nonzero covariances and, thus, do not affect the self-selection terms.

In comparison, if one estimates Equations (1) and (2) in an OLS using the warning and non-warning observations, respectively, the observed coefficients—$\alpha_{1,OLS}$, $\alpha_{0,OLS}$, and β_{OLS}—are potentially inconsistent estimates of the *true* coefficients—α_1, α_0, and β—because of the traditional omitted-correlated-variables problem. That is, the expected value of v_1 for a warning observation is the last term in Equation (4) and the expected value of v_0 for a non-warning observation is the last term in Equation (5). The error terms v_1 and v_0 are expected to be correlated with X as long as $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$ are not 0 and Z and X have common variables. Even though the OLS coefficients are inconsistent for the true coefficients, we can still write Equations (7) and (8). Equation (9) combines Equations (7) and (8) in one regression, where $\theta_{OLS} = \alpha_{1,OLS} - \alpha_{0,OLS}$, representing the between-group return difference after controlling for X:

$$E(R_{1i}|_{warm_i=1}) = \alpha_{1,OLS} + X_i\beta_{OLS}; \tag{7}$$

$$E(R_{0i}|_{warm_i=0}) = \alpha_{0,OLS} + X_i\beta_{OLS}; \tag{8}$$

$$R_i = \alpha_{0,OLS} + \theta_{OLS}Warn_i + X_i\beta_{OLS} + u_i. \tag{9}$$

KL estimate the between-group return difference θ_{OLS}, not the warning effect θ_{TT}. To see the relation between these two, I subtract both sides of Equations (5) from (4), subtract both sides of Equations (8) from (7), and then take the sample average. Both subtractions result in the *same* left-hand side. The right-hand side of the first subtraction is θ_{TT} plus the average difference between warning firms' price adjustments for other bad news and non-warning firms' price adjustments for other bad news—the self-selection effect ("SS"). The right-hand side of the second subtraction is θ_{OLS}. Equating the right-hand sides of both subtractions, I obtain Equation (10): θ_{OLS} can be decomposed into θ_{TT} and SS.[8] If the OLS model rather than the selection model is used, then SS is the estimation bias in determining the warning effect:

$$\theta_{OLS} = \theta_{TT} + E\left[\sigma_{\varepsilon v_1}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)} - \sigma_{\varepsilon v_0}\frac{-\phi(Z_i\gamma)}{1 - \Phi(Z_i\gamma)}\right]. \tag{10}$$

IV. EMPIRICAL PREDICTIONS

I predict that warnings are not penalized by investors (i.e., $\theta_{TT} = 0$) *in the long run* because warnings are voluntary.[9] Otherwise, managers who are presumably rational in making disclosure decisions would stop issuing warnings and the warning phenomenon should

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[8] See Greene (2003, 788). Heckman (2001, 718) shows this decomposition relation in more general terms:

$$\theta_{OLS} = E(R_1|_{warn=1}) - E(R_0|_{warn=0}) = [E(R_1|_{warn=1}) - E(R_0|_{warn=1})] + [E(R_0|_{warn=1}) - E(R_0|_{warn=0})].$$

Adding and subtracting $E(R_0|_{warn=1})$ makes this relation clear. The first bracket on the right-hand side is θ_{TT}, generally called the "treatment effect on the treated group"; the second bracket is SS.

[9] Investors require higher returns from firms for which public information is lacking (Klein and Bawa 1976; Barry and Brown 1985; Easley and O'Hara 2004). So, in theory firms that are forthright with investors receive a market reward. The reward for warnings may be too small to be empirically detected, because a warning is only one disclosure and the incremental transparency is minimal if a firm has been open in the past. Tucker (2006) finds that, relative to warnings firms, non-warning firms lose analyst coverage after failing to warn.

vanish. I examine four major market scenarios that are consistent with this prediction.[10] These scenarios are organized around (1) whether self-selection exists and (2) whether stock prices behave as if investors process news efficiently. In Figure 2, I summarize my predictions for the between-group return difference (θ_{OLS}), warning effect (θ_{TT}), and self-selection effect (SS) in the short- and long-term windows in each scenario.

Scenario A—Efficient Market and No Self-Selection

If managers do not consider non-earnings news when deciding whether to warn, then there is no issue of self-selection and therefore SS is 0 in both the short- and long-term. In the absence of SS, Equation (10) indicates that θ_{OLS} should be same as θ_{TT}, which is predicted to be 0 in the long run. Thus, in this scenario θ_{OLS}, θ_{TT}, and SS are all predicted to be 0 in the long run. If investors fully process news in the short-term, then the short-term returns should be no different from the long-term returns, so my predictions for θ_{OLS}, θ_{TT}, and SS in the short-term are also 0 under Scenario A. Note that KL find a negative θ_{OLS}, invalidating Scenario A. My discussion of this scenario is merely for benchmarking.

Scenario B—Inefficient Market and No Self-Selection

As proposed by KL, investors may overreact to warnings. Investors are often panicked by bad news because, as Kahneman and Tversky (1979) argue, the value function of a risk-averse individual is commonly convex for losses. The market may be more alarmed by warnings than by negative earnings news released by non-warning firms in earnings announcements. For a small number of firms, a warning only foreshadows what is to come, such as deteriorating operations, earnings restatements, SEC investigations, and lawsuits. For example, the warnings by Motorola on July 10, 1996; Gillette on August 14, 1997; and Hewlett-Packard on May 13, 1998 were only the beginning of a series of strategic mishaps and operational failures. The media coverage of such firms may cause investors to overestimate the proportion of troubled firms among warning firms and overreact to the act of warning.

In Scenario B, θ_{OLS} is predicted to be negative in the short-term because of the overreaction. Market overreaction is inevitably corrected in the long-term, so θ_{OLS} should be 0 in the long-term. Because self-selection is not an issue in this scenario, SS is 0 and $\theta_{TT} = \theta_{OLS}$ in both the short- and long-term.

Scenario C—Efficient Market and Self-Selection

Assume managers are more (less) likely to warn when they have more (less) other bad news. If stock prices fully impound such news, then the average return of warning firms should be lower than that of non-warning firms even if both groups have the same risks and earnings news—SS is negative. Because my overall prediction for θ_{TT} in the long run is 0, I expect that θ_{OLS} is equal to SS and is thus negative in the long run in Scenario C. In this efficient market scenario, my predictions for θ_{OLS}, θ_{TT}, and SS in the short-term are the same as those in the long-term.

Scenario D—Inefficient Market and Self-Selection

This scenario deviates from Scenario C in that stock prices do *not* fully impound other bad news in the short-term. All the predictions for the *long-term* in this scenario remain

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[10] In an unreported post-event return test, I find no evidence that investors under-react to non-warning firms' negative earnings surprises. For brevity, this scenario is not proposed in this section.

FIGURE 2
Empirical Predictions

OLS Model: $R_i = \alpha_{0,OLS} + \theta_{OLS}\, Warn_i + X_i\beta_{OLS} + u_i$

Selection Model: $R_i = \alpha_0 + \theta_{TT}\, Warn_i + X_i\beta + \sigma_{\varepsilon v_1} Mill_i * Warn_i + \sigma_{\varepsilon v_0} Mill_i * (1 - Warn_i) + w_i$

Decomposition:

$$\theta_{OLS} = \underset{\substack{\uparrow \\ \text{Warning Effect}}}{\theta_{TT}} + E[\underbrace{\sigma_{\varepsilon v_1}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)} - \sigma_{\varepsilon v_0}\frac{-\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}}_{\substack{\uparrow \\ \text{Self-Selection Effect (SS)}}}]$$

Empirical Predictions for Market Scenarios A (benchmark), B, C, and D:

	Efficient Market			**Inefficient Market**		
No Self-Selection	**A**	ST	LT	**B**	ST	LT
	θ_{OLS}	0	0	θ_{OLS}	Negative	0
	θ_{TT}	0	0	θ_{TT}	Negative	0
	SS	0	0	SS	0	0
Self-Selection	**C**	ST	LT	**D**	ST	LT
	θ_{OLS}	Negative	Negative	θ_{OLS}	Negative	Negative
	θ_{TT}	0	0	θ_{TT}	?	0
	SS	Negative	Negative	SS	?	Negative

In the model, *R* is stock return, *X* is the row vector of variables controlling for risks and earnings news (β is the column vector of coefficients), and *Warn* is 1 for warning firms and 0 for non-warning firms. *Mill* is the inverse Mills ratio, defined as $\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ for a warning firm and $\frac{-\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}$ for a non-warning firm, where $\phi(.)$ is the p.d.f. and $\Phi(.)$ is the c.d.f. of the standard normal distribution and z is the row vector of warning factors observable to researchers. $\sigma_{\varepsilon v_1}$ ($\sigma_{\varepsilon v_0}$) is the covariance of the error terms of the warning model and the regression of *R* on *X* and the constant term using warning (non-warning) observations.

Scenarios A and C are self-explanatory. Scenario B allows for market overreaction to the act of warning. Scenario D allows for incomplete or directionally incorrect stock price adjustments for other bad news in the short-term.

See Figure 3 for the short-term window (ST) and the long-term windows (LT).

the same as those in Scenario C. In the short-term, investors' price adjustments for other bad news may be incomplete or directionally incorrect. Next, I explain why the inefficiency may occur and then explain my predictions for θ_{OLS}, θ_{TT}, and SS in the *short-term.*

Traditional economics assumes that agents are globally rational—they are endowed with information and unlimited ability to process information. In reality, investors are perhaps bounded rational—they make optimal decisions within the constraints of information costs (Simon 1955, 1959; March 1978). Consequently, price discovery takes time as information is gathered and digested (Gonedes 1976; Lee 2001; O'Hara 2003).

By the end of the short-term window, investors could infer other bad news about each firm. Since the direct impact of other bad news on future cash flows may be unclear, investors may need extra time to fully understand the implications of such news. Moreover, investors' price adjustments in the short-term window for other bad news may be incomplete or incorrect *to a larger extent* for non-warning firms than for warning firms for two reasons. First, non-warning firms' negative earnings surprises, given on the earnings announcement date, arrive much later than warnings. Second, investors may pay limited attention to an earnings shortfall disclosed in an earnings announcement because they are occupied with digesting other firms' earnings announcements (Simon 1978; Hirshleifer and Teoh 2003).

In light of KL's finding, I predict θ_{OLS} to be negative in the short-term in Scenario D. Because, as shown in Equation (10), the self-selection effect is the difference between investors' average price adjustment for warning firms $\left(\sigma_{\varepsilon v_1}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}\right)$ and their average price adjustment for non-warning firms $\left(\sigma_{\varepsilon v_0}\frac{-\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}\right)$, SS depends on the signs and magnitudes of $\sigma_{\varepsilon v_1}$ and $\sigma_{\varepsilon v_0}$. Therefore, my prediction for SS in the short-term is unclear. My prediction for θ_{TT} in the short-term is equally unclear because θ_{TT} is the residual effect in θ_{OLS} after SS is removed.

V. VARIABLES

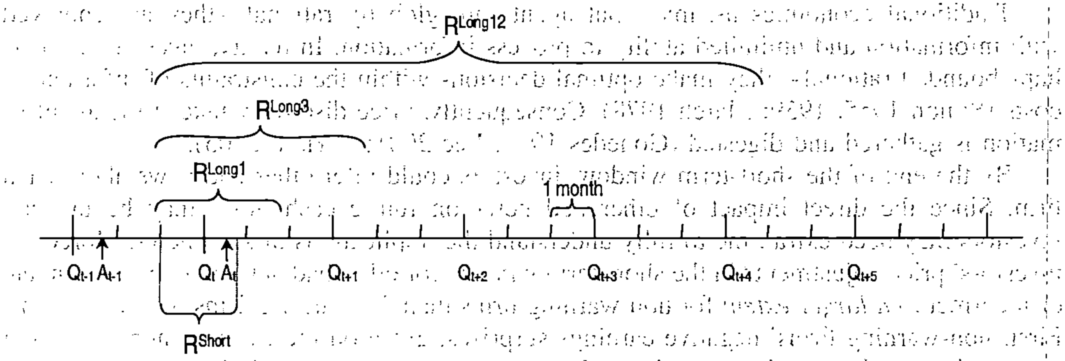
Dependent Variable

The dependent variable in my return analysis is a firm's buy-and-hold return over various windows (Figure 3). The short-term return (R^{Short}) is measured from the beginning of the third fiscal month of the event quarter (i.e., the quarter in which an earnings shortfall occurs) to five days after the event-quarter earnings announcement date. The long-term window extends this window by 1, 2, 3, 6, 9, or 12 months (R^{Long1}, R^{Long2}, R^{Long3}, etc.) after the end of the event-quarter earnings-announcement month. I use various lengths because the speed of price adjustments is unknown. I stop at 12 months out of concern for potential measurement-error problems in long-run returns (Fama 1998, 291).

Control Variables—Factor Returns

The finance literature has identified market risk, firm size, market-to-book ("M/B"), momentum, and industry as factors that affect cross-sectional stock returns. I use a portfolio approach to control for these effects. At the beginning of each month, I form beta deciles, 20 size groups, M/B deciles, momentum deciles, and 48 Fama and French (1997; hereafter Fama-French) industry groups using all U.S. common stocks covered by CRSP and Compustat. Beta is the coefficient on equal-weighted market returns in the market model that uses daily returns in the one-year period before that month. Size is the beginning-of-month market value of equity. M/B is the ratio of the beginning-of-month market value of equity

FIGURE 3
Return Windows



Q represents the end of a fiscal quarter and A represents the earnings announcement date.
R^{Short} is measured from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date.
R^{Long1} is measured from the beginning of the third fiscal month of the event quarter to one month after the end of the event-quarter earnings announcement month.
R^{Long3} is measured from the beginning of the third fiscal month of the event quarter to three months after the end of the event-quarter earnings announcement month.
R^{Long12} is measured from the beginning of the third fiscal month of the event quarter to 12 months after the end of the event-quarter earnings announcement month.

over the book value of equity reported in the most recent quarter. Momentum is measured by the sum of past six-month returns.

To control for each factor, I match a sample observation with a portfolio to which the firm belongs at the beginning of the short-term window. I purge the sample firm-quarters from the benchmark portfolios (Loughran and Ritter 2000, 372 and 382). From each benchmark portfolio, I randomly choose 100 members, calculate the buy-and-hold returns for each member over the same holding period as the dependent variable, and use the equal-weighted mean as the factor return, denoted as R^{beta}, R^{size}, R^{mb}, R^{mom}, and R^{ind}, respectively.[11]

Control Variables—Accounting Characteristics

Previous research finds that accounting information helps investors evaluate risks (Hamada 1969; Beaver et al. 1970). I control for three accounting metrics—leverage, accounting return on assets, and earnings volatility—so that in the tests a firm's stock return is compared with the returns of firms with similar accounting characteristics, in case these metrics capture risks. The three accounting metrics represent three aspects of a firm's business: financial structure, performance, and performance variability. *Leverage* is the average ratio of total liabilities over total assets in the four quarters before the event quarter. *ROA* is the average ratio of earnings before extraordinary items over beginning-of-quarter assets in the four quarters before the event quarter. *EarnVolt* is the standard deviation of accounting return on assets in the eight quarters before the event quarter.

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[11] Finance studies commonly control for these factors by subtracting the benchmark portfolio return (the same size, M/B, and momentum group as the sample firm) from the sample firm's return and then using the excess return as the dependent variable. When the number of factors is large, this approach yields a benchmark portfolio with a small number of firms. For example, if I first sort all the public companies (about 10,000) into five size groups, then five M/B groups for each size group, and finally three momentum groups for each M/B group, I only have 133 firms available for further sorting into 10 beta and 48 industry groups.

Control Variables—Earnings Innovations

I use two variables to capture the change in stock prices due to news. The first variable is the event-quarter earnings surprise (*Surprise*) measured as the difference between the forthcoming earnings per share ("EPS") and analyst consensus (both from I/B/E/S). For warning firms, the consensus is the most recent one compiled before the warning; for non-warning firms, the consensus is the last one before the beginning of the short-term window.

The second variable is future earnings change (*FutureEPS*). I control for *FutureEPS* in the short-term window because stock price leads earnings: a portion of current price change is due to information about future earnings before they are recognized in accounting books (Beaver et al. 1980). I control for *FutureEPS* in the long-term window because stock prices after the event quarter are affected by the portion of future earnings change that investors do not anticipate in the event quarter (Elton 1999, 1214). I measure *FutureEPS* as the change in average diluted EPS (before extraordinary items) from the four quarters before the event to the four quarters after the event. As with KL, I deflate both earnings variables by the split-adjusted stock price at the beginning of the event quarter.

Control Variable—*Mill*

I identify observable variables that capture managers' litigation-, reputation-, and earnings-torpedo-related motives for issuing warnings. For the litigation-related motive, I include (1) general litigation risk (*LitigRisk*), (2) expected legal settlement costs (*LogMVE* and *LogSurprise*), and (3) specific litigation risk from a firm's failure to update a previously issued projection for the event quarter (*Forecast*).

LitigRisk is the probability of being sued (see Appendix B). Because of skewness I use the fractional rankings of this probability in the full sample for the empirical tests. Expected legal costs are higher for larger firms and firms with a larger magnitude of earnings shortfall. The two components arguably have a multiplicative relation (Skinner 1997), so I include the log transformations of both components. *LogMVE* is the log transformation of market value of equity at the beginning of the event quarter. *LogSurprise* is the log transformation of the absolute value of *Surprise*.

If a firm has issued an earnings forecast about the event quarter, then managers may be concerned about potential lawsuits from failing to update or correct the previous projection.[12] Because this situation presents a specific litigation risk for managers, I include a dummy variable *Forecast* to capture this risk. The variable is 1 if a firm issues a forecast about the event quarter before the third fiscal month, and 0 otherwise.

For the reputation-related motive, I use past disclosure frequency (*PastDisclosure*) and analyst following (*PastFollow*). *PastDisclosure* is the number of positive or negative guidelines about quarterly earnings issued by a firm in the 360 days before it announces earnings for the quarter before the event quarter. If First Call does not have records for a firm in this period, then the prior disclosure level is considered 0. *PastFollow* is the average number of analysts whose forecasts are included in the most recent consensus compiled before earnings announcements for the four quarters before the event. As with Frankel and Li (2004), analyst coverage is considered 0 if a firm is not covered by I/B/E/S. I convert *PastDisclosure* and *PastFollow* each into fractional rankings among all firms in the event quarter that are covered by Compustat, CRSP, and I/B/E/S. This conversion controls for potential time trends in First Call, media, and analyst coverage as well as fluctuations in firms' disclosures due to market conditions or the legal environment.

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[12] In the 1979 safe harbor, firms had no duty to update a projection included in a previous SEC filing, but were required to correct the previous projection once it was found false or misleading in light of subsequent events. The Private Securities Litigation Reform Act of 1995 maintains that firms have no duty to update previously released forward-looking information, but the law is quiet about whether firms have a duty to correct. The distinction between "update" and "correct" is ambiguous, causing controversy among legal experts.

To capture the motive of growth firms for softening the earnings-torpedo effect, I use M/B (Skinner and Sloan 2002; Anilowski et al. 2006). Finally, I control for earnings volatility because managers with more volatile earnings may feel less need to warn investors of an earnings fluctuation. In sum, Equation (11) implements the warning model (3). The explanatory variables in Equation (11) constitute the elements of Z in Equation (3):

$$\begin{aligned} Pr(Warn_i = 1) = \Phi(&a_0 + a_1 LitigRisk_i + a_2 LogMVE_i + a_3 LogSurprise_i \\ &+ a_4 Forecast_i + a_5 PastDisclosure_i + a_6 PastFollow_i \\ &+ a_7 M/B_i + a_8 EarnVolt_i + \varepsilon_i). \end{aligned} \tag{11}$$

After estimating Equation (11), I calculate *Mill* as $\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ and $\frac{-\phi(Z_i\gamma)}{1 - \Phi(Z_i\gamma)}$ for a warning and a non-warning firm, respectively (see Section III). *Mill* is then included in the return regression to control for self-selection. Equation (12) implements the selection model (6):

$$\begin{aligned} R_i = c_0 &+ \theta_{TT} Warn_i + c_2 R^{beta}{}_i + c_3 R^{size}{}_i + c_4 R^{mb}{}_i + c_5 R^{mom}{}_i + c_6 R^{ind}{}_i \\ &+ c_7 Leverage_i + c_8 ROA_i + c_9 EarnVolt_i + c_{10} Surprise_i \\ &+ c_{11} FutureEPS_i + \sigma_{\varepsilon\upsilon_1} Mill_i{*}Warn_i + \sigma_{\varepsilon\upsilon_0} Mill_i{*}(1 - Warn_i) + w_i. \end{aligned} \tag{12}$$

VI. DATA

Data Collection

I collect earnings warnings from the First Call Company Issued Guidelines ("CIG") database and use 1996Q1 to 2003Q2 (calendarized) as my sample period.[13] This period starts with 1996 because the passage of the Private Securities Litigation Reform Act of 1995 expanded the safe-harbor protection to firms for issuing forward-looking information, raised the bar for class action lawsuits, and thus changed firms' legal and information environment.

Table 1 summarizes the collection of my warning events. During the sample period, U.S. companies issued 8,692 negative guidelines about quarterly earnings.[14] In addition to

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[13] "Quarter" is calendarized. A firm's fiscal quarter is relabeled to the calendar quarter with which it overlaps most. This procedure improves the control for time effect because only about 67 percent of the firms covered by Compustat end their fiscal years on December 31 and the next most popular fiscal-year-end is June 30.

[14] First Call collects company disclosures from press releases and interviews, compares them with existing market expectations, and codes them as positive, negative, or in-line guidance. To check First Call's positive/negative classification accuracy, I searched the Factiva news database for 100 events randomly chosen from the First Call 2004 data. I found confirmation in the news for 87 events. Among the 13 unconfirmed events, I could not find guidance news for 7 events; for the remaining 6 events I found news that contradicted First Call's classification. The misclassified events are likely excluded from the sample when I delete the events with earnings surprises higher than −0.001 in the data procedures.

TABLE 1
Sample Collection

Panel A: Collection of Warning Events

Procedures	**Change**	**Remaining Events**
Negative guidance about *quarterly* earnings for 1996Q1–2003Q2		8,692
Negative guidance about *annual* earnings issued after the beginning of the last fiscal month of a fiscal year (treated as warnings for Q4)	+181	8,873
Negative guidance about quarterly earnings issued *before* the beginning of the third fiscal month of a fiscal quarter	−3,214	5,659
Missing identifying variables in Compustat, CRSP, or I/B/E/S	−907	4,752
Duplicate warnings for the same fiscal quarter	−75	4,677
Warnings issued since three days before the earnings announcement date	−100	4,577
Unavailable recent analyst consensus before the warning	−25	4,552
Price-deflated earnings surprise higher than −0.001	−469	4,083
Insufficient data for the warning model and return tests	−190	3,893
Penny stocks (stock price less than $2)	−24	3,869
Warning events		3,869

Panel B: Examples of Earnings Warnings

Example 1—Quintiles
"In yet another setback for companies which manage clinical research for drug companies, sector stalwart Quintiles Transnational Corp. took a stock-market beating Thursday after warning Wednesday it would miss third- and fourth-quarter earnings by a wide margin. The announcement caught Wall Street by surprise and sent tremors throughout the industry. Quintiles fell as low as $16.875 at one point Thursday, slightly more than half the previous 52-week low of $30.25, set Aug. 24. Quintiles shares (QTRN) closed down $14.75, or 42%, at $20. Volume was 39.8 million shares, compared with a daily average of 1.5 million. Quintiles said it expects third-quarter earnings of about 27 cents a share, below First Call/Thomson Financial's mean estimate of 36 cents, as a result of early terminations of trials for certain cardiovascular drugs." (*Dow Jones Business News*, "Investors slam Quintiles shares in aftermath of earnings warning," 9/16/1999)

Example 2—Molecular Dynamics Inc.
"A warning its fourth-quarter earnings will come in below analysts' expectations sent shares of Molecular Dynamics Inc. down 38% Friday. The near-term uncertainty of the company's Japan business because of financial turmoil in Asia is also a factor, it said. Molecular Dynamics expects its fourth quarter to come in under analysts' forecasts, and down sequentially from earnings of $1.4 million, or 12 cents a share, in the third quarter. A survey of four analysts polled by First Call projected a mean estimate of 14 cents a share for the fourth quarter ..." (*Dow Jones Online News*, "Molecular Dynamics's shares plunge 38% on lower earnings forecast," 1/9/1998)

events excluded due to missing data, I exclude 3,214 negative guidelines issued before the third fiscal month of a quarter because my study focuses on warnings, not forecasts. I also exclude 469 events of extremely small news, defined as the event-quarter earnings surprise higher than −0.001. Among these events 222 are small negative earnings surprises; they are excluded because managers may be unaware of such a small shortfall. The remaining events are positive earnings surprises according to I/B/E/S even though CIG classifies these events as negative earnings guidelines. To avoid spurious results by penny stocks, which are extremely illiquid and for which market arbitrage is weak (D'Avolio 2002), I delete 24 events whose beginning-of-event-quarter stock price is less than $2. The final number of warnings is 3,869.

The non-warning observations are the firm quarters in which the forthcoming earnings are lower than analyst consensus before the third fiscal month but the firms do not warn. If, according to First Call, a firm issues negative guidance about sales, cash flows, earnings growth, or EBITDA, then this firm quarter is excluded from the non-warning group. I then follow the same procedures used for warning events to exclude extremely small news, penny stocks, and the observations that have insufficient data. These procedures result in 23,158 non-warning observations.

Descriptive Statistics

Table 2 describes the warning and non-warning groups. Warnings are issued by almost all 48 Fama-French industries. Business services, retail, chips, computer, and machinery industries have the highest number of warnings (Panel A).

To compare with prior research, in Table 2, Panel B I report the sum of daily market-adjusted returns in the warning and earnings-announcement event windows as well as in the short-term window. Warning firms experience a mean return of -13.2 percent during the three trading days around warning but the return around earnings announcement is close to 0, suggesting that warning is a timing issue rather than an issue of piecemeal disclosure. For those that have waited to release bad news until earnings announcement, the average three-trading-day return is -2.1 percent. On the other hand, warning and non-warning firms experience a mean return of -19.5 percent and -8.4 percent in the short-term window, respectively. These returns are more negative than the three-day event window returns, probably because of intra-industry information transfer (i.e., a price decline upon peers' warnings) and the arrival of other bad news.

Panel C of Table 2 describes the main variables used in the empirical tests. Warning firms have lower buy-and-hold returns, worse event-quarter earnings news (median), and larger declines in future earnings than non-warning firms. As Barber and Lyon (1997) note, returns tend to be positively skewed when the window is long (e.g., R^{Long12}). Panel D reports the pairwise correlations of the main variables. As predicted, realized returns are positively correlated with both the event-quarter earnings surprise and the change in future earnings.

Panel E of Table 2 presents the correlations between firms' buy-and-hold returns and the factor returns. For brevity, I only report the three-month extension window; the correlations for other windows are similar. The correlation between realized returns and industry factor return is the highest among all correlations involving realized returns; beta factor return comes next. The correlations between the factor returns themselves range from 0.654 to 0.789, yet, according to my variance-inflation-factor analysis (unreported), multicollinearity is not a concern in the multivariate tests.

VII. RESULTS

In this section I first report the warning model estimation. I next present the test results in the short- and long-term windows when self-selection is *not* controlled for. I then report my primary test results—the tests when self-selection *is* controlled for. I briefly note the robustness tests concerning subsamples and model specifications. Finally, I examine post-event returns and evaluate trading strategies to provide supplementary evidence for the primary results. Figure 4 summarizes the key results.[15]

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[15] To avoid spurious relations caused by outliers, I winsorize the dependent and continuous independent variables in the return regressions (except for *Mill*) at 1 percent and 99 percent of the distributions. The test results are very similar when the dependent variables are not winsorized or when robust regressions are used (the latter is robust to outliers in both the dependent and independent variables and to violation of normality in the error term).

TABLE 2
Descriptive Statistics

Panel A: Top 10 Industries with the Largest Number of Warnings[a]

		Warning		Non-Warning		Total	
No.	**Industry**	**#1**	**%**	**#0**	**%**	**#T**	**#1/#T**
1	Business Services	530	13.7%	3,002	13.0%	3,532	15.0%
2	Retail	346	8.9%	1,126	4.9%	1,472	23.5%
3	Chips	343	8.9%	1,529	6.6%	1,872	18.3%
4	Computer	267	6.9%	1,177	5.1%	1,444	18.5%
5	Machinery	191	4.9%	802	3.5%	993	19.2%
6	Wholesale	172	4.4%	837	3.6%	1,009	17.0%
7	Steel Works	118	3.0%	577	2.5%	695	17.0%
8	Transportation	113	2.9%	732	3.2%	845	13.4%
9	Chemicals	111	2.9%	419	1.8%	530	20.9%
10	Lab Equipment	111	2.9%	541	2.3%	652	17.0%
	Other	1,567	40.5%	12,416	53.6%	13,983	11.2%
	Total	3,869	100%	23,158	100%	27,027	14.3%

Panel B: Stock Returns[b]

Mean Return	**Warning (Three-Trading-Day)**	**Earnings Announcement (Three-Trading-Day)**	**Short-Term Window**
Warning	−0.132***	−0.004***	−0.195***
Non-Warning	NA	−0.021***	−0.084***

Panel C: Univariate Analysis of Main Variables

	Warning (3,869)		Non-Warning (23,158)		Between-Group Test (Warning − Non-Warning)	
	Mean	**Median**	**Mean**	**Median**	**t-test**	**Wilcoxon Z**
R^{Short}	−0.164	−0.159	−0.057	−0.054	−27.24***	−26.85***
R^{Long1}	−0.156	−0.160	−0.047	−0.051	−22.28***	−21.65***
R^{Long3}	−0.138	−0.155	−0.035	−0.057	−16.81***	−16.67***
R^{Long12}	−0.056	−0.142	0.064	−0.042	−11.20***	−9.24***
Beta	1.295	1.152	1.247	1.085	3.57***	4.65***
MVE	2,585	432	1,495	226	6.15***	21.42***
M/B	2.872	2.106	2.811	1.825	1.20	9.67***
Leverage	0.483	0.492	0.499	0.510	−4.25***	−3.86***
ROA	0.011	0.013	−0.007	0.005	36.00***	29.02***
EarnVolt	0.019	0.011	0.027	0.012	−15.51***	−7.30***
Surprise	−0.014	−0.007	−0.014	−0.005	1.23	−13.94***
FutureEPS	−0.016	−0.008	−0.009	−0.004	−10.04***	−14.36***

(*continued on next page*)

TABLE 2 (continued)

Panel D: Pairwise Correlations (Pearson in the lower triangle and Spearman in the upper triangle)

	R^{Short}	R^{Long3}	*Leverage*	*ROA*	*EarnVolt*	*Surprise*	*FutureEPS*
R^{Short}		0.609	0.111	0.025	−0.127	0.179	0.124
R^{Long3}	0.611		0.121	0.060	−0.154	0.162	0.231
Leverage	0.083	0.073		−0.046	−0.449	0.040	0.028
ROA	0.035	0.060	0.142		−0.350	0.260	−0.257
EarnVolt	−0.083	−0.084	−0.271	−0.651		−0.264	0.083
Surprise	0.102	0.087	−0.014	0.161	−0.144		0.167
FutureEPS	0.100	0.192	−0.012#	−0.234	0.185	0.152	

Panel E: Pearson Correlations between Stock Returns and Factor Returns[c]

Three-Month Extension	R^{Long3}	R^{beta}	R^{size}	R^{mb}	R^{mom}
R^{beta}	0.389				
R^{size}	0.313	0.735			
R^{mb}	0.340	0.768	0.789		
R^{mom}	0.332	0.774	0.783	0.767	
R^{ind}	0.419	0.690	0.654	0.672	0.671

*** Indicates statistical significance at 1 percent in a two-tailed test.

# Indicates statistical insignificance at 10 percent in a two-tailed test. The unmarked correlations in Panel D are statistically significant at 5 percent in a two-tailed test.

[a] The industries are classified according to Fama and French (1997). See Table 1 for the identification of warning observations. Non-warning observations are the firm quarters for which the forthcoming earnings are less than the most recent analyst consensus before the third fiscal month but the firms do not warn.

[b] The returns are the sum of daily market-adjusted return for each group. The short-term window runs from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date. The three-trading day is [−1, 1], where 0 is the event day.

[c] All the correlations are statistically significant at 1 percent in a two-tailed test. The Spearman correlations are similar and are thus not reported.

Variable Definitions for Panels C and D:

R^{Short} = a firm's buy-and-hold return from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date;

R^{Long1}, R^{Long3}, and R^{Long12} = a firm's buy-and-hold return from the beginning of the third fiscal month of the event quarter to one, three, and 12 months after the end of the event-quarter earnings announcement month, respectively;

Beta = the coefficient on equal-weighted market returns in a market model using daily returns in the one-year period before the event quarter;

MVE = the market value of equity at the beginning of the event quarter (in millions);

M/B = the market-to-book ratio at the beginning of the event quarter;

Leverage = the average debt-to-assets ratio in the four quarters before the event quarter;

ROA = the average accounting return on assets in the four quarters before the event quarter;

EarnVolt = the standard deviation of accounting return on assets in the eight quarters before the event quarter;

FutureEPS = the change in average diluted EPS (before extraordinary items) from the four pre- to the four post-event quarters, deflated by the split-adjusted stock price at the beginning of the event quarter; and

For a warning observation, *Surprise* = the difference between the forthcoming EPS and the most recent analyst consensus before the warning (both earnings are from I/B/E/S). For a non-warning observation, *Surprise* is the difference between the forthcoming EPS and the last analyst consensus before the third fiscal month of the event quarter. Earnings surprise is deflated by the split-adjusted beginning-of-event-quarter stock price.

All variables except for *MVE* are winsorized at 1 percent and 99 percent in the full sample.

(*continued on next page*)

TABLE 2 (continued)

Variable Definitions for Panel E:

R^{Long3} = a firm's buy-and-hold return from the beginning of the third fiscal month of the event quarter to three months after the end of the event-quarter earnings announcement month; and

R^{beta}, R^{size}, R^{mb}, R^{mom}, and R^{ind} = the factor returns. At the beginning of each month, I form beta deciles, 20 firm-size groups, M/B deciles, momentum deciles, and 48 Fama and French (1997) industry groups. Beta is estimated in a market model using daily returns in the one-year period before that month, size is the market value of equity at the beginning of the month, M/B is the ratio of the market value of equity at the beginning of the month over the book value of equity reported in the most recent quarter, and the momentum factor uses the sum of past six-month stock returns. For each warning and non-warning observation, I determine its benchmark portfolio affiliation at the beginning of the third fiscal month. I purge all warning and non-warning observations from the benchmark portfolio, randomly choose 100 members from each portfolio, calculate the buy-and-hold returns for each member over the same holding period as the dependent variable, and use the equal-weighted mean as the factor return.

Warning Model Estimation

Table 3 reports the estimation results. As predicted, firms are more likely to warn if they are riskier, larger, have a larger earning shortfall, issued a forecast for the event quarter early on, gave more disclosures, or had higher analyst following in the past quarters. Firms with more volatile earnings are less likely to warn. The pseudo R^2 is 9.15 percent.[16]

Return Tests without Control for Self-Selection

I first estimate KL's short-term return regression (Table 4, Panel A). The coefficient on *Warn* is significantly negative, consistent with KL and *contradicting Market Scenario A*. The earnings response coefficient is significantly positive at 0.944, whereas KL, Shu (2003), and Xu (2003) all report insignificant coefficients, probably because of their small samples.

Panel B of Table 4 reports my return regression without control for self-selection. The coefficient on *Warn*, θ_{OLS}, is not only significantly negative, but is also surprisingly close to -10 percent across all the windows (including the six-, nine-, and 12-month extensions, unreported). Specifically, θ_{OLS} is -10.1 percent for the short-term window and -9.8 percent for the three-month-extension window. The fact that θ_{OLS} does not change as the window is extended suggests that investors have initially correctly valued the warning group relative to the non-warning group. The negative θ_{OLS} in both the short- and long-term *invalidates Scenario B.*

Return Tests with Control for Self-Selection

Panel C of Table 4 reports my return regression when I add the control for self-selection. The t-statistics are robust to heteroscedasticity (Huber/White/Sandwich standard error estimator). In Panel D of Table 4, I present two alternative estimations that additionally allow for cross-sectional error correlations. Below, I draw inferences from Panel C rather than Panel D because the latter uses only 30 quarterly cross-sections and, as a result of low power, the tests may bias toward finding no warning effect in the long run—my main prediction.

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[16] Aboody and Kasznik (2000) find that managers have an incentive to release pessimistic earnings forecasts before option award dates. My estimation in Table 3 does not control for option grant because the use of option data substantially reduces the sample and its coefficient is insignificant (unreported).

FIGURE 4
Summary of Key Results

		Short Term	Long Term	Post Event
Between-Group Return Difference	θ_{OLS}	−0.101***	−0.098***	0.006#
Warning Effect	θ_{TT}	−0.064***	0.007#	0.079***
Self-Selection Effect	SS	−0.037	−0.105	−0.073
Warning Firms' Coefficient on *Mill*	$\sigma_{\varepsilon v_1}$	−0.034***	−0.067***	−0.035**
Non-Warning Firms' Coefficient on *Mill*	$\sigma_{\varepsilon v_0}$	0.049***	−0.039**	−0.092***

***, ** Indicate statistical significance at 1 percent and 5 percent, respectively, in a two-tailed test.
# Indicates statistical insignificance at 10 percent in a two-tailed test.
Short Term is the short-term window running from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date.
Long Term is the long-term window running from the beginning of the third fiscal month of the event quarter to three months after the end of the event-quarter earnings announcement month.
Post Event is the post-event window that begins on the sixth day after the event-quarter earnings announcement date and ends three months after the end of the event-quarter earnings announcement month.
The short- and long-term test results are reported in Table 4. Specifically, the results for θ_{OLS} are in Panel B; the rest are in Panel C. The post-event test results are reported in Panel A of Table 5.
The statistical significance is shown for the variables except for SS.
See Figure 2 for variable definitions.

Panel C of Table 4 shows that the coefficient on *Warn*, θ_{TT}, is significantly negative in the short-term (coefficient = −6.4 percent, t-statistic = −4.21). The negative θ_{TT} indicates that warning firms earn lower returns in the short-term than those that have similar risks, earnings news, and non-earnings news but do not warn. That is, the market penalizes the act of warning in the short-term. However, the penalty diminishes as the window is extended and it disappears for the two- and three-month extensions (also for the six-, nine-, and 12-month extensions, unreported).

Using the decomposition in Equation (10), I estimate the self-selection effect (SS) to be −3.7 percent for the short-term window and −10.5 percent for the three-month extension. The negative SS indicates that, on average, warning firms have a larger amount of other bad news than non-warning firms. The patterns of θ_{OLS}, θ_{TT}, and SS suggest that, in the short-term, the lower returns of warning firms relative to non-warning firms are due to both a negative warning effect and a negative self-selection effect. However, in the long run they are due purely to self-selection. The evidence is *consistent with Scenario D*, not with Scenario C.

To gain insight into why a warning penalty exists in the short-term, I further examine the components of the self-selection effect and their changes from the short to long-term. Panel C of Table 4 reports the coefficients on *Mill* for the warning and non-warning groups, respectively. Recall that the coefficient on warning firms' *Mill* is the estimate of $\sigma_{\varepsilon v_1}$—the covariance of the error terms of return regression (1) and warning model (3). Similarly, the coefficient on non-warning firms' *Mill* is the estimate of $\sigma_{\varepsilon v_0}$—the covariance of the error terms of return regression (2) and warning model (3). If firms are more (less) likely to warn

TABLE 3
Probit Warning Model

$$Pr(Warn_i = 1) = \Phi(a_0 + a_1 LitigRisk_i + a_2 LogMVE_i + a_3 LogSurprise_i + a_4 Forecast_i + a_5 PastDisclosure_i + a_6 PastFollow_i + a_7 M/B_i + a_8 EarnVolt_i + \varepsilon_i)$$

	Coefficient	z-statistic
Intercept	−2.657	−23.21***
LitigRisk	0.170	4.08***
LogMVE	0.093	10.13***
LogSurprise	0.208	21.41***
Forecast	0.587	16.70***
PastDisclosure	2.033	17.50***
PastFollow	0.474	8.25***
M/B	0.019	5.73***
EarnVolt	−4.500	−11.70***
McFadden Pseudo R^2		9.15%

*** Indicates statistical significance at 1 percent in a two-tailed test. The number of warning and non-warning observations is 3,869 and 23,158, respectively.

Variable Definitions:

Warn = 1 for the warning group and 0 for the non-warning group;

LitigRisk = the full-sample rankings (0 for the lowest and 1 for the highest) of the likelihood of being sued (Appendix B), estimated with the input variables measured in the one-year period before the event quarter;

LogMVE = the log transformation of market value of equity at the beginning of the event quarter (in millions);

LogSurprise = the log transformation of the absolute value of event-quarter earnings surprise; for a warning observation, earnings surprise is the difference between the forthcoming EPS and the most recent analyst consensus before the warning (both from I/B/E/S); for a non-warning observation, it is the difference between the forthcoming EPS and the last analyst consensus before the third fiscal month of the event quarter. Earnings surprise is deflated by the split-adjusted beginning-of-quarter stock price;

Forecast = 1 if a firm has issued earnings forecast about the event quarter before the third fiscal month, and 0 otherwise;

PastDisclosure = the number of positive or negative guidelines about quarterly earnings issued by a firm in the 360 days before the event quarter;

PastFollow = the average number of analysts whose earnings forecasts are included in the most recent consensus before earnings announcement for the four quarters before the event quarter; each of the above two measures is converted into rankings (between 0 and 1) among all firms in the event quarter that are covered by Compustat, CRSP, and I/B/E/S;

M/B = the market-to-book ratio at the beginning of the event quarter; and

EarnVolt = the standard deviation of accounting return on assets in the eight quarters before the event quarter; the above two measures are each winsorized at 1 percent and 99 percent.

when they have more (less) other bad news *and* stock prices fully impound such news, then both covariances should be negative. Panel C shows that they are indeed negative in the long run, but they change from the short to long-term, suggesting within-group mispricing.

Specifically, although $\sigma_{\varepsilon v_1}$ is significantly negative in both the short-term (−0.034) and the three-month extension window (−0.067), its magnitude in the short-term is only half of that in the long-term. This finding suggests that the positions that investors initially take to adjust warning firms' prices for other bad news are correct but the adjustments are inadequate. For the non-warning group, $\sigma_{\varepsilon v_0}$ is significantly negative in the three-month

TABLE 4
Short- and Long-Term Returns

Panel A: KL Return Regression (t-statistics in parentheses, adjusted $R^2 = 3.3\%$)[a]

$$CAR_i = b_0 + b_1 Warn_i + b_2 Surprise_i + b_3 Warn_i * Surprise_i + b_4 LogMVE_i + e_i$$

b_0	$b_1 Warn_i$	$b_2 Surprise_i$	$b_3 Warn_i * Surprise_i$	$b_4 LogMVE_i$
−0.043***	−0.107***	0.944***	0.078	−0.005***
(−7.15)	(−20.83)	(14.51)	(0.38)	(−5.02)

Panel B: Return Regression with *No Control* for Self-Selection

$$R_i = c_0 + \theta_{OLS} Warn_i + c_2 R^{beta}_i + c_3 R^{size}_i + c_4 R^{mb}_i + c_5 R^{mom}_i + c_6 R^{ind}_i + c_7 Leverage_i$$
$$+ c_8 ROA_i + c_9 EarnVolt_i + c_{10} Surprise_i + c_{11} FutureEPS_i + u_i$$

$R =$	R^{Short}	R^{Long1}	R^{Long2}	R^{Long3}
Intercept	−0.079***	−0.076***	−0.085***	−0.079***
	(−19.46)	(−15.00)	(−14.94)	(−12.42)
Warn	−0.101***	−0.101***	−0.102***	−0.098***
	(−28.04)	(−22.96)	(−20.59)	(−17.75)
R^{beta}	0.255***	0.368***	0.382***	0.370***
	(9.25)	(13.93)	(16.62)	(14.75)
R^{size}	0.040	−0.060**	−0.022	−0.084***
	(1.34)	(−2.16)	(−0.81)	(−3.04)
R^{mb}	−0.006	0.014	0.072**	0.116***
	(−0.17)	(0.47)	(2.51)	(4.03)
R^{mom}	0.186***	0.098***	0.038	−0.057**
	(6.02)	(3.49)	(1.47)	(−2.15)
R^{ind}	0.509***	0.497***	0.421***	0.535***
	(23.71)	(24.64)	(26.45)	(27.37)
Leverage	0.050***	0.047***	0.048***	0.048***
	(8.61)	(6.45)	(5.84)	(5.25)
ROA	0.018	0.163**	0.284***	0.446***
	(0.35)	(2.51)	(4.03)	(5.70)
EarnVolt	−0.477***	−0.548***	−0.539***	−0.539***
	(−8.10)	(−7.30)	(−6.43)	(−5.69)
Surprise	0.933***	0.918***	0.883***	0.918***
	(12.58)	(9.74)	(8.46)	(8.21)
FutureEPS	0.455***	0.889***	1.160***	1.470***
	(12.03)	(18.17)	(20.85)	(23.97)
R^2	22.9%	25.0%	24.9%	24.7%

Panel C: Return Regression *with Control* for Self-Selection[b]

$$R_i = c_0 + \theta_{TT} Warn_i + c_2 R^{beta}_i + c_3 R^{size}_i + c_4 R^{mb}_i + c_5 R^{mom}_i + c_6 R^{ind}_i$$
$$+ c_7 Leverage_i + c_8 ROA_i + c_9 EarnVolt_i + c_{10} Surprise_i + c_{11} FutureEPS_i$$
$$+ \sigma_{\varepsilon v_1} Mill_i^* Warn_i + \sigma_{\varepsilon v_0} Mill_i^*(1 - Warn_i) + w_i$$

Intercept	−0.068***	−0.072***	−0.086***	−0.087***
	(−14.46)	(−12.19)	(−13.01)	(−11.89)
Warn	−0.064***	−0.041**	−0.029	0.007
	(−4.21)	(−2.24)	(−1.37)	(0.30)

(*continued on next page*)

TABLE 4 (continued)

R =	R^{Short}	R^{Long1}	R^{Long2}	R^{Long3}
R^{beta}	0.254***	0.337***	0.381***	0.368***
	(9.23)	(13.92)	(16.57)	(14.68)
R^{size}	0.041	−0.059**	−0.020	−0.081***
	(1.40)	(−2.11)	(−0.74)	(−2.94)
R^{mb}	−0.004	0.013	0.072**	0.116***
	(−0.13)	(0.45)	(2.49)	(4.02)
R^{mom}	0.185***	0.097***	0.038	−0.057**
	(5.97)	(3.47)	(1.45)	(−2.15)
R^{ind}	0.508***	0.497***	0.421***	0.535***
	(23.68)	(24.64)	(26.45)	(27.39)
Leverage	0.051***	0.047***	0.047***	0.045***
	(8.81)	(6.40)	(5.67)	(4.90)
ROA	0.032	0.170***	0.287***	0.441***
	(0.63)	(2.62)	(4.06)	(5.63)
EarnVolt	−0.508***	−0.552***	−0.525***	−0.496***
	(−8.56)	(−7.30)	(−6.20)	(−5.20)
Surprise	0.876***	0.904***	0.902***	0.984***
	(11.55)	(9.36)	(8.41)	(8.57)
FutureEPS	0.452***	0.901***	1.164***	1.480***
	(11.93)	(18.18)	(20.91)	(24.11)
*Mill*Warn*	−0.034***	−0.044***	−0.050***	−0.067***
	(−3.40)	(−3.62)	(−3.60)	(−4.27)
Mill(1 − Warn)*	0.049***	0.018	−0.006	−0.039**
	(4.61)	(1.35)	(−0.38)	(−2.39)
R^2	23.0%	25.0%	25.0%	24.7%

Panel D: Robust Standard Error and Fama-MacBeth Regressions[c]

R =	R^{Short}		R^{Long3}	
	Robust Standard Error	**Fama-MacBeth**	**Robust Standard Error**	**Fama-MacBeth**
Intercept	−0.068***	−0.056***	−0.087***	−0.099***
	(−8.27)	(−5.75)	(−7.71)	(−5.27)
Warn	−0.064***	−0.087***	0.007	−0.017
	(−2.58)	(−4.87)	(0.16)	(−0.52)
R^{beta}	0.254**	0.402***	0.368***	0.311***
	(2.43)	(7.71)	(7.73)	(5.83)
R^{size}	0.041	0.087**	−0.081	0.119*
	(0.54)	(1.99)	(−1.18)	(1.81)
R^{mb}	−0.004	0.042	0.116***	0.170***
	(−0.05)	(0.57)	(2.85)	(2.73)
R^{mom}	0.185***	0.075	−0.057	−0.007
	(2.78)	(1.30)	(−1.25)	(−0.20)
R^{ind}	0.508***	0.449***	0.535***	0.485***
	(10.19)	(11.64)	(15.85)	(13.41)
Leverage	0.051***	0.041***	0.045**	0.024
	(4.31)	(3.86)	(2.11)	(1.17)
ROA	0.032	−0.012	0.441***	0.368***
	(0.132)	(−0.13)	(3.10)	(2.73)

(*continued on next page*)

TABLE 4 (continued)

$R =$	R^{Short}		R^{Long3}	
	Robust Standard Error	**Fama-MacBeth**	**Robust Standard Error**	**Fama-MacBeth**
EarnVolt	−0.508***	−0.460***	−0.496***	−0.395***
	(−7.96)	(−7.52)	(−4.69)	(−3.49)
Surprise	0.876***	0.870***	0.984***	1.039***
	(6.73)	(6.09)	(6.20)	(5.02)
FutureEPS	0.452***	0.490***	1.480***	1.524***
	(8.19)	(9.94)	(18.47)	(20.72)
*Mill*Warn*	−0.034***	−0.022**	−0.067***	−0.052***
	(−2.69)	(−2.15)	(−2.71)	(−2.86)
Mill(1 − Warn)*	0.049**	0.057***	−0.039	−0.031
	(2.23)	(2.67)	(−1.16)	(−0.85)
R^2	23.0%	21.0%	24.7%	21.9%

***, **, * Indicate statistical significance at 1 percent, 5 percent, and 10 percent in a two-tailed test, respectively.

The t-statistics are in the parentheses. In Panels B and C, the t-statistics are adjusted for heteroscedasticity (Huber/White/Sandwich standard error estimator).

[a] *CAR* is the sum of daily market-adjusted return from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date. *Surprise* is the earnings surprise, deflated by the beginning-of-quarter stock price. *LogMVE* is the log transformation of market value of equity at the beginning of the event quarter (in millions).

[b] The estimation takes two steps. In the first step I estimate the probit warning model and calculate *Mill*. In the second step I add *Mill* to the return regression and estimate the regression allowing for heteroscedasticity (Huber/White/Sandwich estimator). In the second step the statistical package does not correct the variance for the sampling error from the first step. I compare the test results of a typical treatment-effect regression, for which the statistical package makes the variance correction, with those without variance correction and find little difference.

[c] The robust standard error estimation allows for heteroscedasticity and within-year-quarter error-term correlations (the "reg" procedure in Stata with the "cluster" option). The Fama-MacBeth estimation uses the time-series of coefficient estimates from 30 quarterly cross sections and the mean coefficient estimates and R^2 are reported.

Variable Definitions:

Warn = 1 for a warning observation (3,869) and 0 for a non-warning observation (23,158);
R^{Short} = a firm's buy-and-hold return from the beginning of the third fiscal month of the event quarter to five days after the event-quarter earnings announcement date;
R^{Long1}, R^{Long2}, and R^{Long3} = a firm's buy-and-hold return from the beginning of the third fiscal month of the event quarter to one, two, and three months after the end of the event-quarter earnings announcement month, respectively;

For each warning and non-warning observation, R^{beta}, R^{size}, R^{mb}, R^{mom}, and R^{ind} = the buy-and-hold return of a portfolio of firms in the same beta group (10), firm-size group (20), M/B group (10), return momentum group (10), and Fama-French industry group (48) as the sample firm at the beginning of the third fiscal month, respectively. At the beginning of each month, beta is estimated in a market model using daily returns over the one-year period before that month, size is the market value of equity at the beginning of the month, M/B is the ratio of the market value of equity at the beginning of the month over the book value of equity reported in the most recent quarter, and the momentum factor uses the sum of past six-month stock returns. I purge all warning and non-warning observations from the benchmark portfolio, randomly choose 100 members from each portfolio, calculate the buy-and-hold returns for each member over the same holding period as the dependent variable, and use the equal-weighted mean as the factor return;

Leverage = the average debts-to-assets ratio in the four quarters before the event quarter;
ROA = the average accounting return on assets in the four quarters before the event quarter;
EarnVolt = the standard deviation of accounting return on assets in the eight quarters before the event quarter;

(*continued on next page*)

TABLE 4 (continued)

For a warning observation, *Surprise* = the difference between the forthcoming EPS and the most recent analyst consensus before the warning (both from I/B/E/S). For a non-warning observation, it is the difference between the forthcoming EPS and the last analyst consensus before the third fiscal month of the event quarter. *Surprise* is deflated by the split-adjusted beginning-of-event-quarter stock price;

FutureEPS = the change in average diluted EPS (before extraordinary items) from the four pre- to the four post-event quarters, deflated by the split-adjusted beginning-of-event-quarter price; and

Mill = the inverse Mills ratio, defined as $\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ for a warning firm and $\frac{-\phi(Z_i\gamma)}{1 - \Phi(Z_i\gamma)}$ for a non-warning firm, where ϕ and Φ are standard normal p.d.f. and c.d.f., respectively, Z is the row vector of explanatory variables in the warning choice model, and γ is the column vector of coefficients estimated in Table 3.

All continuous variables except for *Mill* and *LogMVE* are winsorized at 1 percent and 99 percent.

extension window (−0.039), but is significantly positive in the short-term (0.049). The reversal suggests that investors initially make a mistake. In sum, investors are supposed to adjust prices downward for firms with more other bad news relative to those with less *both* within the warning group and within the non-warning group. However, such adjustments do not occur to the non-warning group in the short-term (and the degree of adjustments within the warning group is inadequate). Consequently, a firm with a large amount of other bad news, which therefore tends to warn, is worse off in the short-term for having warned than for being silent.

In unreported tests I partition the sample by Regulation Fair Disclosure (FD) and by the magnitude of earnings surprise. Before FD, some firms might have warned privately but are misclassified into the non-warning group. After FD, managers' private communication channels are legally suppressed, so the potential classification problem is mitigated. I find that the post-FD warning model indeed has a higher pseudo R^2 (16.6 percent) than that from the full sample and that my primary results largely hold in both subperiods.[17] Alternatively, I use 1 percent price-deflated earnings surprise as the cutoff to partition the sample into small- and large-surprise subsamples. My primary results hold in both subsamples.

My use of the selection model has a caveat: The results may be sensitive to the specification of Z because $Z_i\gamma$ determines the magnitude of price adjustments for other bad news. Simply put, the model uses $Z_i\gamma$ that are observable to infer other bad news that is unobservable. The more we know about $Z_i\gamma$, the better inferences we can make about other bad news. For example, if the warning model is weak, the self-selection terms would act like noise such that SS is 0 and $\theta_{TT} = \theta_{OLS}$. My evidence of significant SS alleviates this concern. Although I use the best warning model based on extant evidence, my study may be sensitive to including new warning factors identified from future theories.[18]

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[17] Before FD, θ_{OLS}, θ_{TT}, and SS are −0.134, −0.116, and −0.018 for the short-term window and −0.125, 0.011, and −0.136 for the three-month extension window, respectively. After FD, θ_{OLS}, θ_{TT}, and SS are −0.054, −0.030, and −0.024 for the short-term window and −0.063, 0.012, and −0.075 for the three-month extension window, respectively. Both the between-group return difference and the short-term warning effect are smaller after FD than before FD perhaps because of firms' higher tendency to warn after FD than before FD (Figure 1).

[18] I check how the results are sensitive to the inclusion of already identified warning factors. When the warning model includes only litigation risk, firm size, and earnings surprise, the pseudo R^2 is 4.4 percent and the warning effect is significantly negative even in the long run. After *Forecast* is added, the pseudo R^2 is improved to 6.1 percent and the warning effect is qualitatively similar to my primary results. The warning effect is insensitive to further adding the remaining identified warning factors. My primary results are also insensitive to (1) adding *FutureEPS* to the warning model, (2) excluding *FutureEPS*, *Leverage*, *ROA*, and *Earnvolt* from the return regression, and (3) measuring *FutureEPS* in the eight rather than four quarters after the event quarter.

Supplementary Tests—Post-Event Returns

I examine post-event returns to corroborate the primary results. The post-event windows start on the sixth day following the event-quarter earnings announcement and end at various points as the long-term windows end. Panel A of Table 5 shows that the post-event warning effect is significantly positive. The *positive* warning effect in the post-event windows following the *negative* warning effect in the short-term window explains why the overall warning effect in the long-term window is nil. In addition, the estimate of $\sigma_{\varepsilon v_0}$ is significantly negative, consistent with its reversal from being positive in the short-term to being negative in the long-term, suggesting a correction of short-term mispricing within the non-warning group. The estimate of $\sigma_{\varepsilon v_1}$ is significantly negative in the three-month post-event window, suggesting that three months after the event quarter investors have better understanding of warning firms' other bad news, even though their initial positions are directionally correct.

In the second-to-last row, I *exclude* the self-selection terms and report the coefficient on *Warn*. This coefficient is about 0, indicating no return reversal nor drift after the event quarter. In the last row, I re-estimate the coefficient on *Warn* after further excluding *FutureEPS*. Because all the variables are publicly known at the beginning of the return window, this coefficient essentially estimates the abnormal return from a zero-investment trading strategy of longing warning stocks and shorting non-warning stocks after the event quarter. The coefficient is close to 0, indicating that the strategy based solely on the dichotomy of warning versus non-warning is not profitable, confirming that between-group mispricing does *not* exist.[19]

Further, I form trading strategies to exploit within-group mispricing. I sort warning firms and non-warning firms separately into three groups (high, medium, and low) by the predicted warning probability (P). Note that P is low when $Z_i\gamma$ is low. Recall that within the warning group and within the non-warning group, low $Z_i\gamma$ is associated with high ε_i, so low P is associated with a large amount of other bad news and vice versa. If investors initially do not understand this relation, then an arbitrage strategy of selling the warning firms with low P and buying the warning firms with high P after the event quarter is profitable. A similar strategy is applicable to the non-warning group.

Panel B of Table 5 shows, by subtracting Low P returns from High P, that this strategy earns a mean (median) abnormal return of 2.3 (2.5) percent from the warning group and 2.0 (1.6) percent from the non-warning group. The profit from the warning group is weakly significantly positive ($t = 1.69$; Wilcoxon $Z = 1.65$). The profit from the non-warning group is significantly positive ($t = 3.28$; Wilcoxon $Z = 3.32$). These results support my finding in the primary tests that mispricing exists within the warning group and within the non-warning group. When transaction costs are considered, however, these trading strategies probably yield no net profit (Korajczyk and Sadka 2004). Thus, the evidence of these abnormal returns may not be inconsistent with market efficiency.

VIII. CONCLUSION

My study examines the capital market consequences of voluntary warnings. Using a Heckman selection model to control for price declines due to other bad news, I document

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[19] This result differs from Xu (2003). To replicate her study, I retain only the size, M/B, and momentum factors in the post-event return regression (without the control for self-selection) and further retain only large-surprise firms. I find that the coefficient on *Warn* is positive (coefficient = 0.026, t-statistic = 2.52 for the three-month window; coefficient = 0.043, t-statistic = 1.92 for the 12-month window), contrary to the drift documented by Xu (2003).

TABLE 5
Post-Event Returns

Panel A: Regression Estimation[a]

R =	R^{Post1}	R^{Post2}	R^{Post3}
Intercept	−0.017***	−0.025***	−0.031***
	(−4.08)	(−4.67)	(−4.80)
Warn	0.028**	0.038**	0.079***
	(2.01)	(2.21)	(3.75)
R^{beta}	0.223***	0.240***	0.198***
	(13.31)	(12.60)	(9.39)
R^{size}	0.085***	0.116***	0.064***
	(4.31)	(5.56)	(2.65)
R^{mb}	−0.034	−0.028	0.056**
	(−1.56)	(−1.21)	(2.25)
R^{mom}	−0.039**	−0.059***	−0.078***
	(−2.17)	(−3.02)	(−3.75)
R^{ind}	0.306***	0.372***	0.457***
	(21.33)	(24.00)	(26.42)
Leverage	0.000	−0.000	−0.004
	(0.02)	(−0.02)	(−0.55)
ROA	0.257***	0.364***	0.507***
	(5.54)	(6.42)	(7.56)
EarnVolt	−0.075	−0.113*	−0.088
	(−1.31)	(−1.66)	(−1.07)
Surprise	0.053	−0.030	0.004
	(0.74)	(−0.34)	(0.04)
FutureEPS	0.519***	0.819***	1.140***
	(15.13)	(18.95)	(21.66)
*Mill*Warn*	−0.013	−0.016	−0.035**
	(−1.42)	(−1.41)	(−2.49)
Mill(1 − Warn)*	−0.033***	−0.053***	−0.092***
	(−3.62)	(−4.41)	(−6.43)
R^2	17.8%	19.7%	20.0%
θ_{OLS}	0.000	0.002	0.006
	(0.13)	(0.38)	(1.10)
$\theta_{OLS\ (Excluding\ FutureEPS)}$	−0.001	−0.000	0.003
	(−0.23)	(−0.05)	(0.57)

Panel B: Trading Strategies to Exploit Within-Group Mispricing[b]

Mean (Median)	**Warning Firms**			**Non-Warning Firms**		
↘	**High *P***	**Low *P***	**t-test (Wilcoxon)**	**High *P***	**Low *P***	**t-test (Wilcoxon)**
P	0.344	0.088		0.227	0.057	
	(0.299)	(0.092)		(0.189)	(0.058)	
Abnormal Return	0.011	−0.012	1.69*	0.005	−0.015	3.28***
	(−0.014)	(−0.039)	(1.65*)	(−0.027)	(−0.043)	(3.32***)
Observations	1,482	680		6,765	4,636	

(*continued on next page*)

TABLE 5 (continued)

***, **, * Indicate statistical significance at 1 percent, 5 percent, and 10 percent in a two-tailed test, respectively.

[a] Notes to Panel A

1. The estimation uses 3,869 warning (*Warn* = 1) and 23,158 non-warning (*Warn* = 0) observations.
2. The estimation uses a two-step procedure. In the first step I estimate the warning probit model and calculate *Mill.* In the second step I add *Mill* to the return regression, which is then estimated allowing for heteroscedasticity (Huber/White/Sandwich estimator). The t-statistics are in the parentheses.
3. R^{Post1}, R^{Post2}, and R^{Post3} are a firm's buy-and-hold return from the sixth day after the event-quarter earnings announcement date to one, two, and three months after the end of the event-quarter earnings announcement month, respectively. The three new variables are winsorized at 1 percent and 99 percent in the full sample. See Table 4 for other variable definitions.
4. θ_{OLS} is the least squares coefficient on *Warn* when *Mill* is excluded. The t-statistic is robust to heteroscedasticity.
5. $\theta_{OLS\ (excluding\ FutureEPS)}$ is the least squares coefficient on *Warn* when *Mill* and *FutureEPS* are excluded. The t-statistic is robust to heteroscedasticity.

[b] Notes to Panel B:

1. *P* is the out-of-sample warning probability. Before each quarter between 1998Q1 and 2003Q2, I estimate the warning model using all available warning and non-warning observations prior to the quarter and determine the cutoffs for three warning probability subgroups (high, medium, and low) each within the warning and non-warning groups. I then calculate the out-of-sample warning probability for firms in the current quarter and use the above cutoffs to assign these firms to high, medium, or low *P* groups. To avoid a look-ahead bias, the warning model estimations use unranked variables. The uneven number of firms in "High *P*" and "Low *P*" groups is due to out-of-sample predictions in 22 quarters as well as upward trends in unranked *PastDisclosure* and *PastFollow*.
2. Abnormal Return is the residual obtained from regressing R^{Post3} on R^{beta}, R^{size}, R^{mb}, R^{mom}, R^{ind}, *Leverage*, *ROA*, *Surprise* (all publicly available information), and a constant. See Notes to Panel A and Table 4 for other variable definitions.

interesting findings. Warning firms have, on average, a larger amount of other bad news than non-warning firms. Investors initially do not fully infer and digest other bad news so that the price adjustments for such news in the short-term are incomplete within the warning group and directionally incorrect within the non-warning group. As a result, firms with a large amount of bad news, which therefore tend to warn, are worse off in the short-term for having warned than for being silent. The warning penalty, however, disappears when the short-term window is extended by three months. The evidence suggests that openness is ultimately not penalized by investors.

My study reinterprets Kasznik and Lev's (1995) finding and provides current, relevant evidence that should alleviate managers' concerns about a market penalty for openness. Moreover, my study demonstrates the importance of controlling for self-selection: Without such a control, one would conclude that openness is penalized when in fact it is not. A self-selection bias occurs when some factors (e.g., other bad news), unobservable to researchers, affect the choice decisions of one group (e.g., managers) and the subsequent decisions of another group (e.g., investors). This situation is fairly common in accounting and financial research, such as valuation of firms that choose to expense stock options, cut dividends, or issue new equity. Spurious relations may be drawn if self-selection is not controlled for.

APPENDIX A
STATEMENTS AND PROOFS

Statements

(A1): $\dfrac{\phi(x)}{\Phi(x)}$ is a decreasing function of x.

(A2): $\dfrac{\phi(x)}{1 - \Phi(x)}$ is an increasing function of x.

Here, $\phi(\cdot)$ is the p.d.f. and $\Phi(\cdot)$ is the c.d.f. of the standard normal distribution.

Proofs

(A1): Suppose a random variable w that follows the standard normal distribution is truncated at x from above: $E(w|w < x) = -\dfrac{\phi(x)}{\Phi(x)}$ (Greene 2003, Equation 22-3b).

The mean of the truncated distribution is smaller than the truncation point x: $E(w|w < x) < x$. Therefore:

$$\phi(x) + x\Phi(x) > 0. \tag{A1a}$$

Take the derivative of $\dfrac{\phi(x)}{\Phi(x)}$ with respect to x and use (A1a) in the last step:

$$\frac{d\left(\dfrac{\phi(x)}{\Phi(x)}\right)}{dx} = \frac{\phi'(x)\Phi(x) - \phi(x)\Phi'(x)}{\Phi^2(x)} = \frac{(-x)\phi(x)\Phi(x) - \phi(x)\phi(x)}{\Phi^2(x)}$$
$$= \frac{-\phi(x)[\phi(x) + x\Phi(x)]}{\Phi^2(x)} < 0.$$

Thus, $\dfrac{\phi(x)}{\Phi(x)}$ is a decreasing function of x.

(A2): Suppose a random variable w that follows the standard normal distribution is truncated at x from below: $E(w|w > x) = \dfrac{\phi(x)}{1 - \Phi(x)}$ (Greene 2003, Equation 22-3a).

The mean of the truncated distribution is greater than the truncation point x: $E(w|w > x) > x$. Therefore:

$$\phi(x) - x[1 - \Phi(x)] > 0. \tag{A2a}$$

Take the derivative of $\dfrac{\phi(x)}{1 - \Phi(x)}$ with respect to x and use (A2a) in the last step:

$$\frac{d\left(\frac{\phi(x)}{1-\Phi(x)}\right)}{dx} = \frac{\phi'(x)[1-\Phi(x)] - \phi(x)[1-\Phi(x)]'}{[1-\Phi(x)]^2}$$
$$= \frac{-x\phi(x)[1-\Phi(x)] - \phi(x)[-\phi(x)]}{[1-\Phi(x)]^2}$$
$$= \frac{\phi(x)\{\phi(x) - x[1-\Phi(x)]\}}{[1-\Phi(x)]^2} > 0.$$

Thus, $\frac{\phi(x)}{1-\Phi(x)}$ is an increasing function of x.

APPENDIX B
LITIGATION RISK ESTIMATION

LitigRisk in Equation (11) is the predicted probability of a firm being sued using a litigation model out-of-sample with the input variables measured in the one-year period before the event quarter. The litigation model that I use is similar to those used by Rogers and Stocken (2005) and Johnson et al. (2001). My model estimation uses class action filing data (1996–2000) obtained from the Stanford Securities Class Action Clearinghouse website. The dependent variable *Lawsuit* is 1 for any firm year in which the firm is a defendant in a class action lawsuit filed in that year, and 0 otherwise.

The explanatory variables include firm size, stock turnover, market beta, cumulative stock return, return volatility, and minimum return. For a litigated firm year, the variables are measured in the one-year period before the filing date; for a nonlitigated firm year they are measured over the calendar year. *Size* is the log transformation of average daily market value of equity (in millions of dollars). *Turnover* is the average daily trading volume deflated by the number of shares outstanding. *Beta* is the coefficient on market returns in the market model. *CumRet* is the sum of daily raw returns. *StdRet* is the standard deviation of daily raw returns. *MinRet* is the minimum daily raw return. Firm size, stock turnover, beta, and return volatility are predicted to be positively associated with litigation risk. Cumulative stock return and minimum return are predicted to be negatively associated with litigation risk.

I include three dummy variables for high-tech industries because prior research finds that high-tech firms are more likely to be sued. *BusinessService* is 1 if a firm is a member of Fama-French Industry Group 35, and 0 otherwise. *Computer* is 1 if a firm is a member of Fama-French Industry Group 36, and 0 otherwise. *Chip* is 1 if a firm is a member of Fama-French Industry Group 37, and 0 otherwise:

$$\begin{aligned} Pr(Lawsuit_i = 1) = F(&d_0 + d_1 Size_i + d_2 Turnover_i + d_3 Beta_i + d_4 CumRet_i \\ &+ d_5 StdRet_i + d_6 MinRet_i + d_7 BusinessService_i \\ &+ d_8 Computer_i + d_9 Chip_i + \varepsilon_i). \end{aligned}$$

Table B1 reports the estimation. The coefficients on *Size*, *Turnover*, *Beta*, *CumRet*, and *MinRet* are consistent with the predictions. The coefficient on *StdRet* is significantly negative, contrary to my prediction. Firms in the computer industry face significantly higher litigation risk.

TABLE B1
Litigation Model Estimation

Variable	Coefficient	Chi-Square
Intercept	−3.531	1106.71***
Size	0.110	67.72***
Turnover	18.330	136.57***
Beta	0.119	24.85***
CumRet	−0.206	49.62***
StdRet	−14.061	101.13***
MinRet	−4.570	531.79***
BusinessService	−0.010	0.02
Computer	0.233	8.45***
Chip	0.041	0.22
McFadden Pseudo R^2		26.7%
426 litigated and 38,150 nonlitigated firm year observations		

*** Indicates statistical significance at 1 percent, in a two-tailed test.

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BOOK REVIEW

Stephen A. Zeff, Editor

Editor's note: Two copies of books for review should be sent to the Book Review Editor: Stephen A. Zeff, Rice University, Jesse H. Jones Graduate School of Management, 6100 Main St., Houston, TX 77005. The policy of *The Accounting Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.

THOMAS A. KING, *More Than a Numbers Game: A Brief History of Accounting* (Hoboken, NJ: John Wiley and Sons, Inc., 2006, pp. xiii, 242, $29.95).

More Than a Numbers Game: A Brief History of Accounting is a breezy read that is divided into 15 rather short and snappy chapters. Each chapter addresses a different aspect of accounting history, beginning in the early nineteenth century, which the book pieces together in a story that helps the reader to better understand how we arrived at where we are today. For example, in the chapter on railroads we see the importance of financial accounting and a balance-sheet focus that served as a communications tool when addressing the concerns of absentee owners. Here too the concept of depreciation arose as a means of dealing with aging equipment. In the chapter on taxes we see the prominent impact of income tax law on accounting, including the birth of LIFO and the emergence of deferred taxes. In the chapter entitled "Science," we witness the origins of modern accounting research, including the influence on accounting of what the author describes as "three great finance ideas": the efficient markets hypothesis, the capital asset pricing model, and the Black-Scholes option pricing model.

Other chapter topics include the development of cost or managerial accounting, with its historical perspective on terms like opportunity cost, sunk costs, and suboptimization; intangibles, including purchased versus internally developed intangible assets, and the debate over valuation and amortization; earnings and the more recent primacy of the income statement, earnings per share, and analyst estimates; accounting standards and the politicization of accounting; and certainly the recent accounting frauds and the passage of the Sarbanes-Oxley Act. In the "Epilogue," the author describes accounting as having "four dialects": financial accounting, tax accounting, cost accounting, and statutory accounting. According to the author, these dialects developed in the absence of any unifying theory in order to answer the ubiquitous question, "How am I doing?"

There is much accounting trivia in this book. But that trivia is anything but trivial. These short facts will provide the accounting instructor and student with perspective and background that will enhance the teaching and learning of accounting. Consider, for example, Boston Manufacturing Co., which the author describes as the first modern American corporation. The company had but 11 owners when it was first organized in 1813, clearly demonstrating the likelihood at the time of few absentee owners. As another example, there is pooling-of-interests accounting, which emerged in a court case whose facts centered on the value assigned to the combined plant of two merging power companies. Managements at the power companies were unhappy with the verdict, as it lowered their rate base. However, for years afterward it was a boon to many other combining companies by allowing them to reduce goodwill and boost future earnings. Also, there is the FASB's statement on troubled debt restructurings. By failing to force lenders to take a charge to earnings in such instances, FASB laid the foundation for the 1980s Savings and Loan crisis that ultimately cost taxpayers billions of dollars. Finally, while we are reminded every day about the many accounting scandals that have occurred in recent years, Depression-era regulators provided us with a period of four decades without a major accounting scandal.

The book has some useful analogies that paint a clear picture for readers to better help them grasp topics. For example, in describing earnings, a bathtub analogy is used where the water level represents wealth at a point in time. Water inflowing from the spout represents revenues and gains. Outflows down the drain represent expenses and losses. Income is the amount of water that could be removed during a period without reducing the opening water level.

Some of the points made in the book are arguable, or at least in need of additional clarification. For example, the author describes Generally Accepted Accounting Principles as an amorphous set that no one has successfully codified. He could have made reference to the ongoing FASB codification project. He characterizes whether or not to capitalize expenses as "perhaps" the most important accounting decision. One could quibble with that characterization, given the number of frauds involving revenue recognition. Readers too could find ample room to debate the point made that we have yet to develop a widely accepted definition of income. These are minor points, however, and in no way do they detract from the overall effort.

Much time and research went into the writing of *More Than a Numbers Game: A Brief History of Accounting*. The author, Thomas A. King, is a practicing financial professional. He has experience in public accounting and in industry, where he has been responsible for both crafting financial policies and explaining them to outside users. His reader is treated to a relatively short book that pulls together into a single place the many historical underpinnings that guide present accounting thought. As such, the book provides useful background regarding the historical origins of accounting standards and practice that will serve both accounting researchers and practitioners well.

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Editorial Data

The following table contains information about turnaround time for manuscripts (including revisions) on which editorial decisions were made in the 12-month period ended December 31, 2006. Turnaround time is the number of days between the date that the manuscript was received *and the date of the editor's letter to the author(s).*

	Number of Manuscripts	Percent	Cumulative Number	Cumulative Percent
0 ≤ Days ≤ 30	68	16.23	68	16.23
31 ≤ Days ≤ 60	173	41.29	241	50.96
61 ≤ Days ≤ 90	110	26.25	351	83.77
91 ≤ Days ≤ 120	52	12.41	403	96.18
121 ≤ Days	16	3.82	419	100.00
Total	419	100.00		

The mean review time was 58.66; the median review time was 56 days.

New Submissions by calendar year (January 1 to December 31)

1992	241
1993	234
1994	231
1995	195
1996	230
1997	195
1998	196
1999	239
2000	260
2001	260*
2002	324
2003	327
2004	307
2005	389
2006	413

* 2001—in addition to the 260 regular submissions, 68 MSs were submitted to the *TAR* Quality of Earnings Conference.

The acceptance rate (defined as number of MSs accepted divided by the number of new submissions) over the past 5 years is between 12–16% per year.

EDITORIAL POLICY AND STYLE INFORMATION

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Percentages and Decimal Fractions: In nontechnical copy use the word percent in the text.

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An Abstract of about 100 words should be presented on a separate page immediately preceding the text. The Abstract should concisely inform the reader of the manuscript's topic, its methods, and its findings. Keywords and the Data Availability statements should follow the Abstract. The text of the paper should start with a section labeled "I. Introduction," which provides more details about the paper's purpose, motivation, methodology, and findings. Both the Abstract and the Introduction should be relatively nontechnical, yet clear enough for an informed reader to understand the manuscript's contribution. The manuscript's title, but neither the author's name nor other identification designations, should appear on the Abstract page.

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Fabozzi, F., and I. Pollack, eds. 1987. *The Handbook of Fixed Income Securities*. 2nd edition. Homewood, IL: Dow Jones-Irwin.
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The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The ***Review*** *is published in January, March, May, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233-2399, ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding.*

401 UNIVERSITY OF COLORADO AT DENVER, Business School and Health Sciences Center (UCDHSC) seeks tenure-track Accounting faculty. The Accounting Program at UCDHSC is separately accredited by AACSB. Required Qualifications: Candidates must have a Ph.D. in Accounting or ABD and a demonstrated commitment to excellence in research and teaching. Specialization in managerial accounting or accounting information systems is preferred, though all areas will be considered. Review of applications will begin immediately, and continue until position is filled. Provide: cover letter, *cv*/resume, three professional references, working papers and/or publications, and teaching accomplishments. Complete an electronic application at: http://www.jobsatcu.com/applicants/Central?quickFind=51794 *and* send requested materials to: Bruce R. Neumann, Director, Accounting Programs, Business School, Campus Box 165, PO Box 173364, Denver CO 80217-3364; Email: bruce.neumann@cudenver.edu. The University of Colorado is committed to diversity and equality in education and employment.

402 WEST VIRGINIA UNIVERSITY, Division of Accounting, Morgantown, WV invites applications for *three* tenure-track positions for Assistant or Associate Professor of Accounting with teaching and research interests in financial accounting, information systems, and/or auditing. Candidates with secondary interests and prior experience in specialty areas including white-collar crime, fraud investigation, and forensic accounting will receive special consideration. Positions are available beginning August 2007 or January 2008. Relevant professional certification(s) is (are) also highly desirable (CPA, CFE, CFI, or related credential). Candidates should have an earned doctorate in accounting or information systems from an AACSB-accredited institution (or ABD nearing completion). Salary will be commensurate with qualifications with summer research, travel and professional development support. Application letter, *vita*, names or letters of references, and evidence of excellence in professional activities, teaching, and scholarship may be mailed to: Professor Timothy A. Pearson, WVU College of Business and Economics, Morgantown, WV 26506-6025; or sent electronically to: Timothy.Pearson@mail.wvu.edu. Applications will be accepted immediately and reviews will continue until position is filled. WVU is an Affirmative Action/Equal Opportunity Institution.

403 UNIVERSITY OF LOUISIANA AT MONROE invites applications for a tenure-track Assistant/Associate Professor of Accounting starting August 2007. The College of Business at ULM promotes a balance between teaching and intellectual contributions, combined with professional service to the university, discipline, and community. The Accounting Program and the College of Business Administration are both accredited by AACSB International. Candidates must have an earned doctorate (or ABD nearing completion) with appropriate professional certification and/or experience. Applicants should provide evidence of excellence in teaching and scholarship, *curriculum vitae*, transcripts, and names of three references. Applications will be considered until the position is filled; direct applications to: Dr. Michelle McEacharn, University of Louisiana at Monroe, 700 University Avenue, Monroe, LA 71209-0110. The University is an Equal Opportunity/Affirmative Action Employer located in a metropolitan area of 150,000 persons. For more information, visit the ULM website: http://www.ulm.edu.

404 UNIVERSITY OF NEVADA, LAS VEGAS, College of Business, an AACSB-accredited college at both undergraduate and graduate levels, invites applications for an Assistant Professor in Accounting to start Fall 2007. The position requires a primary interest in financial and/or auditing and involves teaching at the undergraduate and graduate levels, conducting significant research leading to high-quality refereed publications, and performing service activities. Candidates must have a strong academic record and have demonstrated potential for excellence in both research and teaching. A doctoral degree in accounting from an AACSB-accredited school is required, but ABDs near completion will be considered. Salary competitive; contingent on market. This position is contingent upon funding. Application details may be obtained by visiting: http://hr.unlv.edu/Employment_Svcs. UNLV is an Equal Opportunity/Affirmative Action Employer committed to excellence through diversity.

405 VALVTECHNOLOGIES, INC. combines the strengths of a global industry leader together with the qualities of a family owned, privately held business. We seek a highly experienced accounting/finance professional to be our Controller. To qualify, you must be a CPA with 5 years of Controller experience in a privately held manufacturing company or a large division of a major manufacturer, together with 3–5 years of experience as a Business Analyst and 3–5 years in a General Accounting Manager/Supervisor role. A B.S. (accounting/finance) is required, an M.B.A. preferred. Your demonstrated field of knowledge must encompass GAAP, internal control processes, payroll, accounts payable, accounts receivable, taxation and treasury practices. You must be well versed in strategic/business planning, due diligence, acquisition integration, international accounting (U.K./Europe), financial analysis/auditing/reporting, and risk management. Strong IT/enterprise system implementation experience is desired. We offer excellent benefits and competitive wages. Please email resume to: recruiting@valv.com; or Fax: (713) 860-0499. EOE.

406 WEST VIRGINIA UNIVERSITY, Division of Accounting, Morgantown, WV invites applications for *two* Lecturer of Accounting positions beginning August 2007. This is a full-time, non-tenure-track academic year appointment. The position is renewable, subject to performance and staffing needs. Areas of need include financial accounting, managerial accounting and forensic accounting. Candidates should have a master's degree in accounting with professional certification. Salary will be commensurate with qualifications. Summer and overload teaching may be available. Travel and professional development support is also available. Application letter, *vita*, names or letters of references, and evidence of excellence in professional activities, teaching, and scholarship may be mailed to: Professor Timothy A. Pearson, WVU College of Business and Economics, Morgantown, WV 26506-6025; or sent electronically to: Timothy.Pearson@mail.wvu.edu. Applications will be accepted immediately and reviews will continue until position is filled. WVU is an Affirmative Action/Equal Opportunity Institution.

407 LOYOLA MARYMOUNT UNIVERSITY, Department of Accounting invites applicants for two full-time, tenure-track faculty positions at Assistant/Associate rank effective Fall 2008. A doctorate (or short-term ABD status) in accounting from an AACSB-accredited university is required. All candidates should demonstrate a strong commitment to scholarly research and excellence in teaching. Our priority is for teaching in the Financial Accounting and AIS areas. Salary is competitive and research support is available. Loyola Marymount, a comprehensive university in the mainstream of American Catholic higher education, seeks professionally outstanding applicants who value its mission and share its commitment to academic excellence, the education of the whole person, and the building of a just society. If you are interested in learning more about these positions, contact: Professor Mahmoud Nourayi, Department of Accounting, College of Business Administration, Loyola Marymount University, One LMU Drive, Los Angeles, CA 90045-2659. LMU is an Equal Opportunity institution actively working to promote an intercultural learning community. Women and minorities are encouraged to apply. For more information visit: http://www.lmu.edu.

408 KEISER COLLEGE seeks graduate faculty members in the academic disciplines of Managerial Economics, International Business, Management, Accounting as well as Marketing. An earned D.B.A. or Ph.D. in Business with a related discipline from a regionally accredited institution is required. While young scholars will be considered, favored candidates will have had previous teaching experience, preferably at the graduate level. A strong and recent a record of presentations, research activities, and publications is required. Continued scholarly activity is expected. The institution is offering a competitive salary and benefit package. Résumés with cover letter and other supporting documentation should be sent to Lawrence Wang at: lwang@keisercollege.edu.

409 MARIST COLLEGE seeks an Assistant/Associate Professor of Accounting beginning August 2008. Candidates must have a commitment to excellence in teaching and substantive research in accounting. Candidates with either an interest or experience in teaching financial accounting are preferred. This tenure-track position will require teaching at both the undergraduate and graduate levels (including online courses) as well as maintaining a high level of professional activity through research and service. Candidates should have an earned doctorate in accounting or a related field, or an anticipated completion date during the Fall 2008. Professional experience and certification is a definite plus. The business and accounting programs in the School of Management are fully accredited by AACSB International. Review of applications will begin immediately. Please submit a current *vitae*, letter of interest, and contact information for least three professional references via email to: human.resources@marist.edu. Indicate position in subject line.

410 UNIVERSITY OF NORTH TEXAS invites applications and nominations for the position of Chairperson, Department of Accounting, beginning Fall 2007 or Spring/Fall 2008. The chairperson is responsible for providing academic, administrative, and professional leadership for the department. The position includes limited teaching responsibilities. The department Chairperson reports to the Senior Associate Dean of the College of Business Administration. The University of North Texas is an emerging national research institution located in the vibrant and rapidly expanding Dallas-Fort Worth metropolitan area and situated in close proximity to DFW International Airport. University enrollment is over 33,000 students with more than 6,500 graduate students. Accounting programs are offered at the undergraduate, master's, and doctoral levels. Review of applications will begin immediately and continue until the position is filled. Each application should include: letter of interest; professional resume; and the names, addresses, and telephone numbers of three references. Applications and nominations should be sent to: Dr. Teresa Conover, Search Committee Chair, Department of Accounting, University of North Texas, PO Box 305219, Denton, TX 76203-5219; or submitted electronically to naudei@unt.edu. The University of North Texas is an Equal Opportunity Employer. Women and minorities are encouraged to apply.

411 LASELL COLLEGE, Department of Business Administration seeks applicants for a full-time, Assistant Professor of Accountancy beginning in the Fall 2007. Responsibilities: Teaching responsibilities include courses in the areas of Accounting Principles, Financial Management, Taxes, and Cost. Supervision of the Volunteer Income Tax Assistance Program is a critical component of this position. Qualifications: An M.B.A., M.S.A., or Ph.D. is required. Certification as a CPA or CMA, prior college teaching experience, and professional experience in accounting are preferred. The successful candidate must be able to work cooperatively and productively with faculty, staff, and students, show evidence of excellent teaching and student advocacy, professional development and productivity, and a commitment to campus service and student advising. Faculty at Lasell are employed on renewable single and multi-year contracts. Screening of applicants will begin immediately and continue until the position is filled. Candidates should send a cover letter, a philosophy of teaching, resume, and names of three references to: Employment, Lasell College, 1844 Commonwealth Avenue Newton, MA 02466; Fax: (617) 243-2105; Email: employment@lasell.edu. Minority applicants are strongly encouraged to apply.

412 AUBURN UNIVERSITY MONTGOMERY, Department of Accounting and Finance, invites applicants for a tenure-track Accounting position at the Assistant, Associate or Full Professor level beginning August 2007. Candidates must hold a doctoral degree or be ABD and near completion. Applicants must have demonstrated potential for quality teaching and research. Qualified individuals in any specialty area of accounting will be considered. Auburn University Montgomery is the metropolitan campus of the state's land grant university. The School of Business is accredited by the AACSB at both the graduate and undergraduate levels. Review of applications will continue until the position is filled. Contact: Dr. Lee Gurley, Head, Department of Accounting and Finance, School of Business, Auburn University Montgomery, PO Box 244023, Montgomery, AL 36124-4023: Phone: (334) 244-3227; Email: lgurley@mail.aum.edu. Auburn University Montgomery is an EEO/AA Employer and Educator.

413 NATIONAL CENTER FOR CONTINUING EDUCATION seeks advanced Excel seminar leader. Applicants must have in-depth knowledge of Excel, financial expertise, and experienced public speaking skills. Top dollar for top talent. This position requires instruction from four to six days per month. Interested candidates should send letter and *curriculum vitae* to Angel Henningsen, Marketing Director: angelh@nccetraining.com.

414 WALSH COLLEGE invites you to join the faculty of Accountancy and Business Administration and continue the tradition of preparing students to perform well on the Uniform CPA Exam and in their careers. Responsibilities: Teach at least eight courses per academic year, primarily in advanced accounting and auditing. Develop course materials and student assessment vehicles to assure appropriate levels of academic standards are maintained. Assist in revising curricula, managing adjunct faculty members, and advising students. Participate in scholarly activities that contribute to the profession. Requirements: A doctorate in accounting *or* a doctorate in accounting education or business education with a CPA *or* a related master's degree, CPA, and ten years of recent professional accounting experience. General teaching or trainer experience required (tutoring or seminar instruction will qualify). College level teaching experience preferred. Superior communication skills required. Send resume and salary requirements to: HR, Walsh College, 3838 Livernois Road, Troy, MI 48007-7006; or E-mail: hr@walshcollege.edu.

415 UNIVERSITY OF NORTH TEXAS invites applications for a tenure-track position at any academic rank and at any level of experience for a position in Managerial Accounting. The position is available Fall 2007. Candidates must possess an earned doctorate with an emphasis in accounting and should have teaching experience, as well as research accomplishments, commensurate with the rank to which they are appointed. Appropriate certification is desirable. Applications will be considered until the position is filled. Candidates should submit a letter of application, *curriculum vitae*, and the names, addresses, and telephone numbers of four references to: Chair, Search Committee, Department of Accounting, PO Box 305219, Denton, TX 76203-5219. For further information, contact: Professor Paul Hutchison at: hutchp@unt.edu. The University of North Texas, located in the Dallas-Fort Worth metroplex, is a metropolitan research university with an enrollment in excess of 32,000 students. Accounting programs are offered at the undergraduate, master's, and doctoral levels. The University of North Texas is an Equal Opportunity Employer. Women and minorities are encouraged to apply. Visit: http://www.coba.unt.edu/acct.

416 VIRGINIA COMMONWEALTH UNIVERSITY, Department of Accounting invites applications for a full-time, tenure-track faculty member in Auditing who has a commitment to excellence in research and teaching. The position is effective August 16, 2008. The successful candidate will be able to teach at both the undergraduate and graduate levels. The Department of Accounting in the School of Business offers an undergraduate major in accounting; a master of accountancy; master of taxation; a doctorate in accounting; and a post-baccalaureate certificate in accounting for degree-holding students. The School is AACSB-accredited and the Department holds separate AACSB-accreditation. Candidates are to have an earned doctorate by August 2008 in the appropriate field and have a commitment to excellence in research and teaching. Professional certification is desirable. The review process begins September 30, 2007 and will continue until the position is filled. Applicants should send a *vitae* and letters or names of three references to: Dr. Edward N. Coffman, Chair of the Department of Accounting, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA 23284-4000; Email: encoffma@vcu.edu. VCU is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women, minorities and persons with disabilities.

417 VIRGINIA COMMONWEALTH UNIVERSITY, Department of Accounting invites applications for a full-time, tenure-track faculty member in Financial Accounting with a commitment to excellence in research and teaching. The position is effective August 16, 2008. The successful candidate will be able to teach at both the undergraduate and graduate levels. The Department of Accounting in the School of Business offers an undergraduate major in accounting; a master of accountancy; a master of taxation; a doctorate in accounting; and a post-baccalaureate certificate in accounting for degree-holding students. The School is AACSB-accredited and the Department holds separate AACSB-accreditation. Candidates are to have an earned doctorate by August 2008 in the appropriate field and have a commitment to excellence in research and teaching. Professional certification is desirable. The review process begins September 30, 2007 and will continue until the position is filled. Applicants should send a *vitae* and letters or names of three references to: Dr. Edward N. Coffman, Chair of the Department of Accounting, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA 23284-4000; Email: encoffma@vcu.edu. VCU is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women, minorities and persons with disabilities.

418 DALTON STATE COLLEGE is recruiting a tenure-track Assistant/Associate or Visiting Professor to teach undergraduate accounting courses beginning Fall 2007. Standard teaching load is three courses per semester. A Ph.D. in accounting is required with professional certification and relevant work experience preferred. Applicants must be able to demonstrate a commitment to both teaching and research, and be academically qualified in accordance with AACSB standards. DSC is located along I-75 between Atlanta and Chattanooga. Diverse housing options include mountain, waterfront, urban, and suburban settings. The Division of Business equally respects and encourages pedagogical, applied, and basic research. We characterize ourselves as a teaching college with a collegial faculty that values work-life balance. Interested persons should submit a letter of application, *vitae*, statement of teaching philosophy, three references and transcripts to: Dr. Cassie Bradley, Division of Business Administration, Dalton State College, 650 College Drive, Dalton, GA 30720. DSC is an EEO/AA Employer.

419 UNIVERSITY OF MISSISSIPPI, School of Accountancy seeks to fill a tenure-track position at the Assistant, Associate, or Full Professor level beginning the fall semester 2007. Interest in teaching and research in the area of auditing is preferred, but all areas will be considered. Applications must include (1) a letter which details your qualifications and stating what you would seek to achieve as a member of the Ole Miss faculty, (2) a current *vita*, and (3) the names and contact information of three references. Review of applicants will begin immediately and continue until the position is filled. Applications must be submitted at: https://jobs.olemiss.edu (paper applications cannot be accepted). For further information contact: Dr. Rick Elam, Reynolds Professor of Accountancy, Patterson School of Accountancy, The University of Mississippi, University, MS 38677-1848; Email: relam@olemiss.edu; Phone: 662-915-5281. The University of Mississippi is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA Employer.

420 SUNGKYUNKWAN UNIVERSITY SKK, Graduate School of Business seeks applications for a tenure-track position (Assistant or Associate Professor) in Financial Accounting to begin in the fall of 2008. SKK GSB is a business school newly founded by Sungkyunkwan University with the assistance of the Samsung Group and in collaboration with the MIT Sloan School of Management. Our mission is to become the best M.B.A. program in Asia. Salary and teaching loads are highly competitive. Generous fringe benefits include free housing, education allowance for international schools, and medical insurance. All candidates must have a doctoral degree in Accounting prior to the appointment. Candidates should show their strong potential for and/or record of excellence in research and M.B.A. teaching. Excellent English communication skills are required. Applicants should submit a cover letter, an updated *curriculum vitae*, an example of written work for presentation, three letters of reference, and evidence of teaching effectiveness to: Dr. Jae Ha Lee, Associate Dean, SKK GSB, Sungkyunkwan University, 53 Myungryun-dong 3-ga, Jongro-gu, Seoul, Korea 110-745; Phone: 82-2-740-1505; Email: gsbfaculty@skku.edu. Review of applications will begin immediately and continue until the position is filled. Additional information about SKK GSB can be found at: http://gsb.skku.edu.

421 PURDUE UNIVERSITY, Krannert Graduate School of Management invites applicants for one Continuous Term Lecturer appointment in accounting beginning Fall 2007. Candidates are expected to teach both financial and managerial accounting predominantly at the undergraduate level and should have demonstrated excellence in teaching. Teaching load is 18 to 24 semester credit hours per academic year. Ph.D. preferred but master's degree with professional certification (e.g., CPA) is acceptable. The initial appointment is subject to renewal based on performance and need. Applications will be reviewed beginning April 18, 2007 and should include a *vitae*, evidence of teaching performance, and three letters of reference. Applications should be sent to: Professor Susan Watts, Krannert Graduate School of Management, Purdue University, 403 W. State Street, West Lafayette, IN 47907-2056. Purdue is an Equal Access, Equal Opportunity/Affirmative Action Employer. Women, individuals in under-represented groups and individuals with disabilities are encouraged to apply.

422 PURDUE UNIVERSITY, Accounting Area in the Krannert Graduate School of Management seeks one or more visitors at the Assistant or Associate level beginning Fall of the 2007–2008 academic year. Graduate teaching may be available for experienced candidates and we expect that some combination of undergraduate teaching in managerial, financial, and auditing classes will also be available. Teaching load is 12 semester credit hours per academic year. Candidates should have (or be near completion of) a doctorate or Ph.D. Applications should be sent to: Professor Mark Bagnoli, Krannert Graduate School of Management, Purdue University, West Lafayette, IN 47907. Review of applications will begin April 18, 2007 and continue until the position is filled. Purdue is an Equal Access, Equal Opportunity/Affirmative Action Employer. Women, individuals in under-represented groups and individuals with disabilities are encouraged to apply.

423 WEST VIRGINIA UNIVERSITY, Division of Accounting, Morgantown WV invites applications for a full-time, non-tenure-track, clinical instructor position for Associate Director of the Forensic Accounting and Fraud Investigation (FAFI) Program beginning August 2007. The position includes primarily administrative, outreach and instructional responsibilities; however, research contributions will be highly valued. The position is for three years and renewable, subject to performance and staffing needs. Prior experience in auditing, forensic accounting, fraud examination, law enforcement, legal investigations, and/or serving as consulting expert or testifying expert in litigation support services are desired but not necessarily required. Relevant professional certification(s) is (are) also highly desirable (CPA, CFE, CFI, or related credential). Candidates should have a master's degree in accounting with professional certification. Candidates with an earned doctorate in accounting from an AACSB-accredited institution will be given special consideration. Salary will be commensurate with qualifications. Travel and professional development support is available. Summer and overload teaching may be available. Application letter, *vita*, names or letters of references, and evidence of excellence in professional activities, teaching. and scholarship may be mailed to: Professor Timothy A. Pearson, WVU College of Business and Economics, Morgantown, WV 26506-6025; or sent electronically to: Timothy.Pearson@mail.wvu.edu. Applications will be accepted immediately and reviews will continue until position is filled. WVU is an Affirmative Action/Equal Opportunity Institution.

424 DePAUL UNIVERSITY, School of Accountancy and MIS invites applications for a tenure-track position at the Assistant, Associate, or Full Professor level starting in Fall 2008. Candidates must hold a doctoral degree in Accounting from an AACSB-accredited school. ABDs will be considered if completion of dissertation is anticipated by starting date. Candidates should demonstrate potential for success in scholarly research and excellence in teaching. Qualified individuals in all specialty areas of accounting will be considered. Salary and benefits are competitive with AACSB schools. Review of applications will begin immediately and will continue until the position is filled. Interested applicants should submit *curriculum vita*, samples of scholarly work, teaching evaluations, and two letters of reference to: Phillip Chomiak, Coordinator of Faculty and Curriculum School of Accountancy and MIS, DePaul University, One East Jackson Blvd.; Chicago, IL 60604; Email: pchomiak@depaul.edu, Please submit applications by July 30 if you wish to be considered for an interview at the AAA meeting in Chicago, IL. Information about DePaul University can be found at: http://www.depaul.edu . Information about the School of Accountancy and MIS can be found at: http://accountancy.depaul.edu.

425 MICHIGAN TECHNOLOGICAL UNIVERSITY invites applicants for a tenure-track Assistant/ Associate/Full Professor in Accounting starting August 2008. This position requires a Ph.D. in Accounting from an AACSB-accredited institution. The successful candidate is expected to develop a vigorous, nationally visible research program as well as contribute effectively to undergraduate and graduate instruction in the School of Business and Economics (http://www.sbe.mtu.edu). The SBE is AACSB-accredited, offers competitive salaries, attractive benefits, and a reduced teaching load and start-up funding for junior faculty. MTU is a nationally recognized research university and a leader in science and engineering education. It is located in the scenic Upper Midwest, a safe, affordable environment with excellent opportunities for year-round outdoor recreation. (http://hunts-upguide.com/). Interested candidates should send a letter of application, *cv*, evidence of scholarship and teaching effectiveness, and three references to: Dr. Christa Walck, Dean, School of Business and Economics at: sbe-search@mtu.edu. MTU is an Affirmative Action/ Equal Opportunity Employer.

426 UNIVERSITY OF WISCONSIN–OSHKOSH invites applications for one tenure-track Assistant/ Associate level position beginning Fall 2008. All candidates are invited to reply, but preference is given those with primary interest in Government/Nonprofit, Managerial, and/or AIS. In addition to teaching in area(s) of specialization, responsibilities include introductory undergraduate and graduate courses. Candidates must provide evidence of quality teaching and be strongly committed to teaching, scholarship, and service. Applicants must have doctorate or ABD (completion required by start date) in accounting from AACSB-accredited institution. Professional experience and certification desirable. The College of Business is accredited by AACSB. For more information, refer to: http://www.uwosh.edu/hr/unclassified_positions.php. Applications received by August 31, 2007 will be guaranteed consideration. Send application letter, resume, evidence of quality teaching, and contact information for three references to: Donna Molus (Assistant), College of Business, University of Wisconsin Oshkosh, 800 Algoma Boulevard, Oshkosh WI 54901; or Email: molus@uwosh.edu. UW Oshkosh is an AA/EEO employer.

427 BALL STATE UNIVERSITY invites nominations and applications for the Dean of the Miller College of Business. For detailed information, visit the university website: http://www.bsu.edu/hrs.

428 BOSTON COLLEGE, Wallace E. Carroll School of Management Department of Accounting invites applications for a faculty position at the Associate/Full Professor rank for Fall 2008. The qualified candidate must have a record of publishing in premier academic journals and continuing interest in conducting significant scholarly research and teaching excellence. Research interests in financial accounting or auditing is preferred. We seek individuals with an openness to diverse intellectual interests and an appreciation for Boston College's liberal arts tradition. We offer a collegial environment and an energetic faculty with close ties to the Boston financial and academic communities. Direct inquiries and applications to: Billy Soo, Chair, Department of Accounting, Carroll School of Management, Boston College, Chestnut Hill, MA 02467. The Carroll School of Management is an Equal Opportunity Employer.

429 BOISE STATE UNIVERSITY, Department of Accountancy invites applications for a tenure-track financial accounting position at the Assistant rank starting Fall 2008. A Ph.D. in accounting is required but ABDs nearing completion will be considered. Professional certification is desired. Expectations include a commitment to high-quality teaching, scholarship leading to refereed publications and university and community service. Both the College and Department's undergraduate and graduate programs are AACSB-accredited. BSU is located in downtown Boise, a thriving community offering city amenities and convenient access to an array of outdoor recreational opportunities. Salary is competitive within the western region. Review of applications begins October 15, 2007, and continues until the position is filled. For more information regarding this position and application procedures, please visit: http://hrs.boisestate.edu/joblistings/faculty/. Boise State University is an EEO/AA institution, veteran's preference.

430 COLLEGE OF CHARLESTON, Charleston, South Carolina invites applications for tenure-track or visiting positions at the Assistant or Associate Professor level beginning in Fall 2007 or Spring 2008. Two positions are available; primary needs are in financial and management accounting. The College of Charleston offers the BS in Accounting and Master of Science in Accountancy degrees. Information about our programs can be found at: http://www.cofc.edu/~acctls. Candidates are expected to have a Ph.D. degree from an AACSB-accredited university by the time employment begins. Teaching experience, business experience, and professional certification are desirable. Applicants should send a cover letter and *vitae* to: koprowskiw@cofc.edu; or mail to: William Koprowski, Department of Accounting and Legal Studies, 66 George Street, Charleston, SC 29424; Phone: (843) 953-7835. The College of Charleston strongly encourages applications from women, minorities, and persons with disabilities. The College of Charleston is committed to creating a diverse community.

431 FLORIDA ATLANTIC UNIVERSITY, School of Accounting invites applications for tenure-track positions at Assistant/Associate Professor levels starting August 2008. Positions are expected at our Port St. Lucie (positions #980889 and 980888) and Boca Raton (position #992960) campuses subject to budgetary approval. Candidates must have earned a Ph.D., D.B.A., or be close to completing the degree. Applicants for rank above Assistant Professor must have a distinguished record. The Barry Kaye College of Business at FAU is accredited by the AACSB and salary is competitive. FAU faculty will be attending the national AAA Annual Meeting in August 2007 and would like to meet with interested candidates. Review of applications will begin immediately and continue until the positions are filled. Send letter of application (with position numbers), *curriculum vitae*, sample of your research, and names of three references to: Recruiting Committee, School of Accounting, Barry Kaye College of Business, Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431. Electronic copies of the above are preferred and should be sent to: soa@fau.edu with "2008 Faculty Position" in the subject line (online application is at: http://jobs.fau.edu). FAU does not discriminate on the basis of race, color, national origin, sex, religion, age, disability, veteran status, or sexual orientation in employment and applicants may be subject to a background check.

432 MISSOURI WESTERN STATE UNIVERSITY invites applications for a tenure-track accounting position beginning January or August 2008. Rank and area of specialization negotiable. Ph.D. in Accountancy required by time of appointment. Teaching and applied experience preferred. MWSU offers varied resources to encourage intellectual contributions and strong collegial atmosphere in a mid-sized city with an arts and history focus, within an hour of the professional sports, music, and theatre of Kansas City. Contact to set up an appointment at AAA. Application review will begin October 1 and continue until position is filled. Please send a letter of application, transcript copies, current *vitae*, contact information for four references, and evidence of teaching effectiveness to: Carol Roever, Chair, Accounting Search Committee, Department of Business, 4525 Downs Drive, St. Joseph, MO 64507. Finalists will be asked to provide current recommendation letters. MWSU is an Equal Employment and Educational Opportunity Institution.

433 EASTERN MICHIGAN UNIVERSITY seeks applicants for a tenure-track Assistant Professor position to begin Fall 2008, subject to availability of funding. A primary interest in accounting information systems and a secondary interest in financial or managerial accounting is desired. A Ph.D. with a major in accounting from an AACSB-accredited school or its equivalent is required; however, an ABD with substantial evidence of completion will be considered. CPA or other professional certifications and teaching experience desired. Salary is competitive. EMU is a public, comprehensive university of 25,000 students in southeastern Michigan and the College of Business is AACSB-accredited. Submit letter, *curriculum vita*, transcripts, teaching evaluations, and three reference letters to: Accounting Faculty Position, EMU Academic Human Resources, 202 Boone Hall, Ypsilanti, MI 48197. Review of applications will start immediately and continue until the positions are filled. For more information, contact: Dr. Susan Kattelus at: susan.kattelus@emich.edu, or go to: http://www.accfin.emich.edu. AA/EOE.

434 BRYANT UNIVERSITY, Department of Accounting invites applications to fill a tenure-track Assistant Professor position starting August 1, 2008. Bryant University is a private AACSB-accredited university with undergraduate and master's degree programs in accounting. Quality teaching and research productivity are expected of faculty members. The salary is competitive. Candidates must either be ABD or have completed a doctorate accounting program accredited by AACSB. Preference will be given to candidates able to teach courses in any two of the following areas: AIS, Financial, Managerial, and Auditing. Candidates with an established record of research productivity will be given preference. Complete information regarding the required application process is available online at: http://employment.bryant.edu. To receive full consideration, interested persons must apply electronically. The review of applications will begin immediately and the position will remain open until filled. Bryant is an EEO/AA Employer and an institution committed to diversifying its faculty.

435 CENTRAL STATE UNIVERSITY, Department of Accounting and Economics is seeking to fill a position for Fall 2007. Position: Assistant or Associate Professor of Accounting. Qualifications: A Doctorate in Accounting or closely related field, or a Master's in Accounting with an excellent academic record and be a CPA. The successful candidate must be able to teach all accounting courses offered at the undergraduate level. Preference will be given to applicants with: (1) professional certifications, (e.g., CPA, CMA, or CIA); (2) a record of successful teaching; (3) work experience in an accounting related position. Please send applications to: Human Resources, Central State University, 1400 Brush Row Rd., PO Box 1004, Wilberforce, OH 45384. Applications can be sent to: applications.hr@centralstate.edu. Employment Applications can be found at: http://www.centralstate.edu/administration/HRdept/forms.htm.

436 UNIVERSITY OF NEUCHATEL, Faculty of Economics seeks applications for a Full Professorship in Financial Accounting. Candidates should have an established record of quality research and teaching as well as several years of experience. We are interested in candidates experienced in teaching financial accounting and with a teaching interest in Master Programs. Candidates are expected to take teaching and administrative responsibilities including the Master Programs. Teaching languages are French and English. Non-French speakers are expected to be fluent in French after four years. Women applications encouraged. Send *curriculum vitae* (teaching and research activities description, complete publications list), detailed research agenda, copies of degrees/diplomas, scientific agenda, three recommendation letters to: Décanat de la Faculté des sciences économiques, Université de Neuchâtel, Pierre-à-Mazel 7, CH-2000 Neuchâtel, Switzerland; and electronic version to: Dean of Faculty at: doyen.seco@unine.ch. Start date: February, 2008 or to be agreed. Application deadline: June, 30 2007. Details: contact Professor Stoffel at: doyen.seco@unine.ch; and website: http://www.unine.ch/seco.

437 QUEENS COLLEGE–CITY UNIVERSITY OF NEW YORK, Department of Accounting and Information Systems seeks two tenure-track Assistant Professors, commencing Spring or Fall 2008, whose primary instructional responsibilities will be to teach undergraduate and graduate courses in one or more of the following areas: financial accounting, accounting information systems, governmental and not-for-profit accounting, taxation, and auditing. A doctorate in accounting/information systems or a related discipline is required by the commencement of employment. Preference will be given to candidates with a publication record and success at college-level teaching. The ability to communicate well orally and in writing with one of the most ethnically diverse student populations in the United States is mandatory. Please send a cover letter, *cv*, a brief statement of teaching interests and philosophy, and arrange to have three current letters of recommendation sent (please include their names and contact information in your *cv*) to: Dr. Marvin F. Milich, Department of Accounting and Information Systems, Queens College–CUNY, 65-30 Kissena Blvd, Flushing, NY 11367-1597; or Email: marvin.milich@qc.cuny.edu. Complete applications, including letters of recommendation, must be received by the September 15, 2007. AA/EOE/IRCA/ADA.

438 UNIVERSITY OF LETHBRIDGE (Alberta, Canada) is seeking applications for a tenure-track position beginning July 2008 at any rank from persons with teaching and research interests in Financial Accounting or Auditing. Applicants should possess a relevant doctorate or be in the final stages of completing their dissertation. Professional certification is preferred. A commitment to teaching excellence and publishing research in quality journals is required. The teaching load is four courses per year and research support is available. The faculty is a balanced school, where both research and teaching are equally valued. All qualified candidates are encouraged to apply; however, Canadians and Permanent Residents will be given priority. For the full ad, see: http://www.uleth.ca/man/people/jobs/. Send your application—*cv*, evidence of teaching and research effectiveness, and three letters of reference—directly to: management.dean@uleth.ca including. Representatives from the Faculty of Management will be in attendance at the AAA Annual Meeting in Chicago.

439 PEPPERDINE UNIVERSITY, Graziadio School of Business and Management seeks an experienced Assistant or Associate Professor in Accounting starting Fall 2008. We value teaching excellence, a productive research record, and professional experience. Candidates must have an earned doctorate in Accounting or be in the final stages of their dissertation. Applications should include a cover letter, resume, teaching evaluations, a sample research paper, and unofficial transcripts showing degrees earned. For full consideration, please apply by October 1, 2007. Contact: Dr. Richard Powell, Graziadio School of Business, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA 90263; Phone: (310) 506-4874; Email: rpowell@pepperdine.edu. Dr. Powell will be interviewing candidates at the 2007 AAA Annual Meeting in Chicago. For additional information, see our half-page display ad that appears in the July 2007 issue of *The Accounting Review.*

440 HOLY FAMILY UNIVERSITY, School of Business Administration invites applications for a full-time position at the rank of Assistant Professor in Accounting to begin August 2008. Ability to demonstrate quality teaching is required. Successful candidates will also be expected to participate in the full range of faculty responsibilities, including scholarly research appropriate to the position and the requirements for AACSB-accreditation. Applicants should possess an earned doctorate in accounting or anticipate completion by August 2008. Economists with proven accounting research and publication record are also encouraged to apply. To receive consideration by the search committee, candidates must submit a letter of application and *cv* to: Dr. Cao Jiang, School of Business Administration, Holy Family University, 9801 Frankford Ave., Philadelphia PA. 19114. EOE.

441 NORTHERN ILLINOIS UNIVERSITY invites applications for anticipated tenure-track openings for accountancy faculty at the rank of Assistant or Associate Professor beginning Fall 2008. We are primarily interested in candidates who have a teaching interest in Managerial Accounting, Governmental Accounting, or Accounting Information Systems. NIU offers the Bachelor of Science in Accountancy, Master of Accounting Science, and Master of Science in Taxation degrees. Information about our nationally ranked programs can be found at: http://www.cob.niu.edu/accy/. Candidates must be qualified to teach at the undergraduate and graduate levels. Candidates should have, or expect to have, a Ph.D. degree when employment begins. Teaching experience, business experience, and professional certification are desirable. We are particularly interested in faculty who want to combine their research and teaching with a close working relationship with the professional business community. Applicants must send a cover letter and *curriculum vitae* to: Jim Young, Chair, Department of Accountancy, Northern Illinois University, DeKalb, IL 60115. Complete applications must be received by August 17, 2007. NIU representatives will be available at the AAA Annual Meeting in Chicago, IL. AA/EEO Institution.

442 UNIVERSITY OF ALABAMA IN HUNTSVILLE invites applications for a tenure-track Assistant/Associate Professor in Financial Accounting starting August 2008. Associate-level applicants should possess a Ph.D. and an established track record of refereed publications. Assistant-level applicants should have the Ph.D. or be completed by December 2008. Huntsville is a dynamic, prosperous, and technologically oriented community with award-winning schools and rich cultural and recreational opportunities. Nestled in the foothills of the Appalachian mountains, the population of the area is 350,000. For more information visit our website: http://cas.uah.edu. Please send a letter of application and *vita* (with names and addresses of three professional references) via to: accsearch@uah.edu. Include reference number 08/09-197. For information, please contact: Dr. Dorla Evans, (256) 824-6764. Review of applications begins immediately and remains open until filled. Dr. Evans can be contacted at the Chicago Hilton during AAA Annual Meeting or by cell: (256) 665-4079. UAH is an AA/EEO. We seek candidates with diverse backgrounds and experiences.

443 UNIVERSITY OF SCRANTON, Kania School of Management is seeking qualified applicants for three tenure-track positions beginning August 2008. The Kania School of Management is AACSB-accredited and offers courses at the undergraduate and M.B.A. levels. The primary teaching responsibilities will be in Auditing and Computer Auditing; Accounting Information Systems and the Information Systems Auditing areas; also, teaching Taxation, which includes responsible for administering the University's VITA program. Minimum qualifications include an appropriate earned doctorate or ABD progressing toward completion. Preliminary interviews will be conducted at the AAA Annual Meeting in Chicago in August 2007, by Dr. Robyn Lawrence, chairperson (staying at the conference hotel). Interested applicants may submit a letter of interest, *vita*, official transcripts, and contact information for three references to: Dr. Robyn Lawrence, University of Scranton, Kania School of Management, 320 Madison Avenue, Scranton, PA 18510-4602; or Email: accounting@scranton.edu. Applications will be considered until the positions are filled. The University of Scranton is an AA/EO Employer/Educator.

PEPPERDINE UNIVERSITY
Graziadio School of Business and Management

Seeking Experienced Assistant or Associate Professor in Accounting

The Graziadio School of Business & Management, Pepperdine University, seeks an experienced assistant or associate professor in Accounting starting Fall 2008. We value teaching excellence, a productive research record, and professional experience.

Candidates must have an earned doctorate in Accounting or be in the final stages of their dissertation. A CPA or CMA is desirable. Research support includes access to WRDS (Wharton Research Data Services) with Compustat and CRSP. The school encourages its faculty to engage in consulting activity.

As an AACSB accredited school, we have a full-time MBA program based on our Malibu campus and the largest part-time MBA program in Southern California. This part-time program is taught in the evenings at five locations throughout the Los Angeles area. The teaching needs are primarily in Financial Accounting and Managerial Accounting. Research interests can lie in any of the traditional areas of Accounting.

Applications should include a cover letter, resume, teaching evaluations, a sample research paper, and unofficial transcripts showing degrees earned. For full consideration, please apply by October 1, 2007. Contact: Dr. Richard Powell, Graziadio School of Business, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA 90263, (310) 506-4874, rpowell@pepperdine.edu. Dr. Powell will be interviewing candidates at the Annual Meeting of the American Accounting Association to be held in August 2007 in Chicago.

Pepperdine University is an Equal Opportunity Employer and does not unlawfully discriminate on the basis of any status or condition protected by applicable federal or state law. Religiously affiliated with the Churches of Christ, it is the purpose of Pepperdine to pursue the very highest employment and academic standards within a context which celebrates and extends the spiritual and ethical ideals of the Christian faith. While students, faculty, staff and members of the Board of Regents represent many religious backgrounds, Pepperdine reserves the right to seek, hire and promote persons who support the goals and mission of the institution.

GRADIENT

analytics

Position: Senior Editor of Earnings Quality Analytics at Gradient Analytics. The Director will work in the corporate headquarters in Scottsdale Arizona and report to the President and CEO while working closely with co-founder and Editor-in-Chief Dr. Donn Vickrey, the analysts and the team manager. This position is a full-time position but may be offered on a one-year basis (if the candidate chooses to take a leave of absence from their academic position). Salary and benefits will be commensurate with experience and market-competitive.

Qualifications: Accounting PhD with research interest in earnings management issues with capital market ramifications. A successful candidate must be a very strong writer and enjoy the rigors of academic research and the practical application of the research for financial markets. They must be a creative thinker, deadline driven, persistent and have a healthy dose of skepticism.

About Earnings Quality Analytics: An analyst-driven service providing forensic accounting and corporate governance analysis of widely held companies leveraging the latest academic research, as well as our proprietary quantitative models and data. The research reports service is sold primarily to a growing base of institutional money managers. www.earningsqualityanalytics.com

About Gradient Analytics: As the Country's leading independent research firm, Gradient Analytics provides objective, academically-rigorous, research and technology solutions enabling clients to generate actionable investment ideas and better manage risk. www.gradientanalytics.com

To Apply: E-mail cover letter and detailed vitae to the attention of Human Resources at hr@gradientanalytics.com.

INDIANA UNIVERSITY–PURDUE UNIVERSITY FORT WAYNE

IPFW

DEAN
DOERMER SCHOOL OF BUSINESS AND MANAGEMENT SCIENCES

ndiana University-Purdue University Fort Wayne (IPFW) seeks a Dean to lead the Richard T. Doermer School of Business and Management Sciences.

THE UNIVERSITY AND THE SCHOOL

PFW is the largest, most comprehensive university in northeast Indiana, enrolls nearly 12,000 students from all 50 states and more than 40 countries and offers more than 190 undergraduate and graduate programs. The University is also home to nine Centers of Excellence, providing expertise and resources to the community.

The Richard T. Doermer School of Business and Management Sciences is the only business school n northeast Indiana accredited by AACSB-International and aspires to become a leading urban regional business school with national recognition. The School consists of the Departments of Accounting & Finance, Economics, and Management & Marketing. Undergraduate and graduate earning opportunities include the Associate of Science in Business, Bachelor of Science in Business and Master of Business Administration degrees. A certificate program in accounting is offered, and certificates in entrepreneurship and enterprise resource planning are in development. The School currently has 34 full-time faculty and serves 750 undergraduate and 180 graduate students.

THE DEAN

The Dean's primary responsibilities include: assessment and AACSB accreditation; academic oversight and planning; budget development and management; collaboration with faculty, chairs, senior administration and the business community; constituency relations and fundraising; faculty and staff development and evaluation. The official IPFW dean's job description is available at **www.ipfw.edu/vcaa/forms/PDFs/OAA%2005-2.pdf.**

The ideal candidate must demonstrate evidence of: exemplary academic qualifications (AQ as defined by AACSB-International) in one of the disciplines within the School, including an earned doctorate and a record of outstanding academic achievement necessary for appointment as a tenured full professor; successful academic leadership experience at the department chair level or above, including curricular design, strategic planning, mobilization of others around a common vision, and the personal skills to effectively interact with the School's internal and external stake holders; commitment to student success, faculty excellence in teaching and research, institutional diversity, and community outreach.

Desired qualifications include experience with AACSB-International accreditation; knowledge of global business opportunities and potential interdisciplinary partnerships, both internal and external to the School; and private sector business experience.

APPLICATIONS AND NOMINATIONS

Nominations and applications will be held in confidence. Applications should include a letter outlining the applicant's background, qualifications and vision for the position, curriculum vitae/resume, and contact information for three professional references. Review of applications will begin immediately and will continue until the position is filled. Please send materials in electronic form to: **IPFW@eflassociates.com.**

EFL Associates is assisting this search. Please direct all inquiries, nominations and applications to: **Dr. David G. Homer, Managing Director, Higher Education Practice, Phone: 617-948-2540, Fax: 617-948-2501.**

IPFW is an Equal Opportunity/Equal Access/Affirmative Action University.